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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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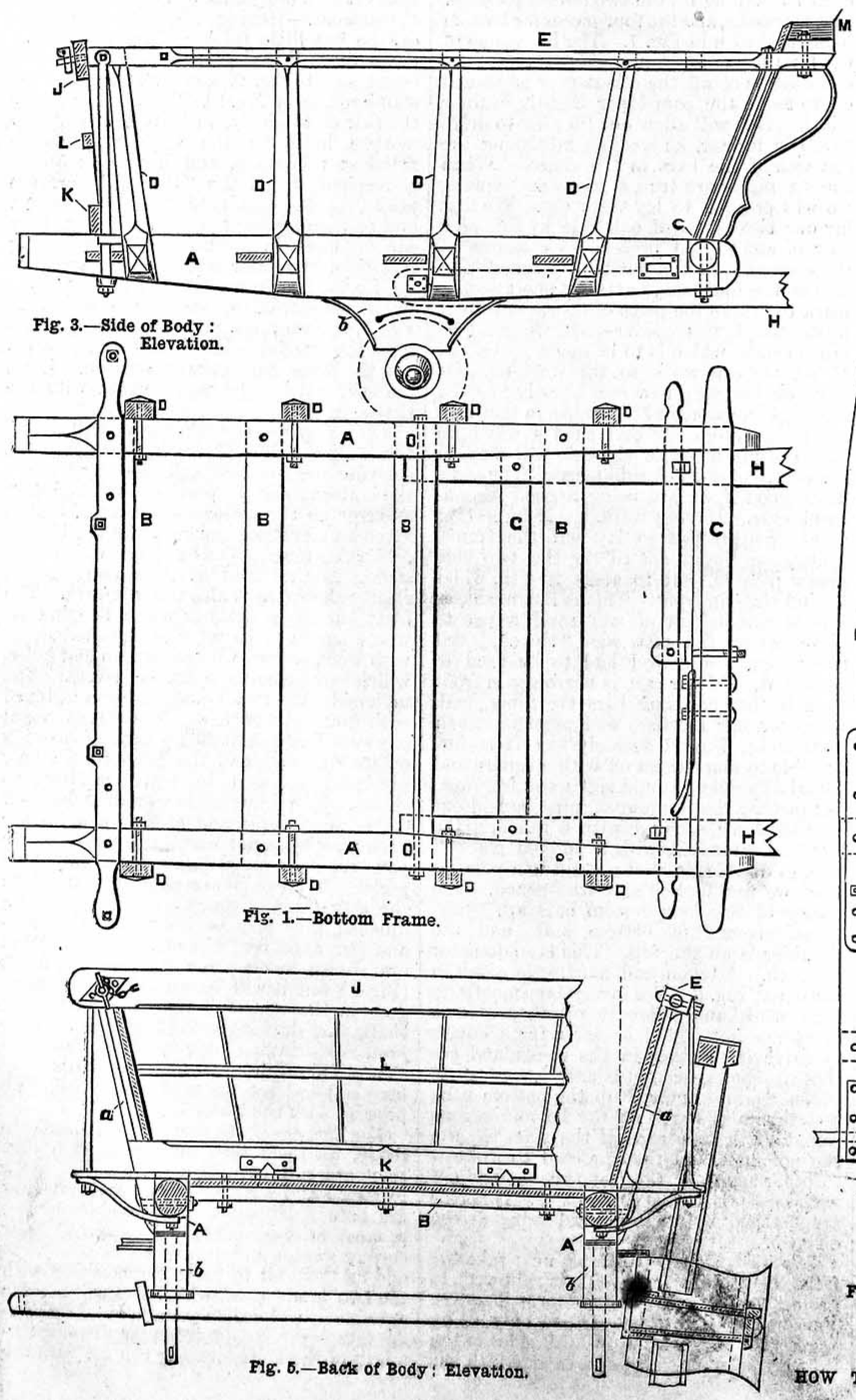


Fig. 3.—Side of Body: Elevation.

Fig. 1.—Bottom Frame.

Fig. 5.—Back of Body: Elevation.

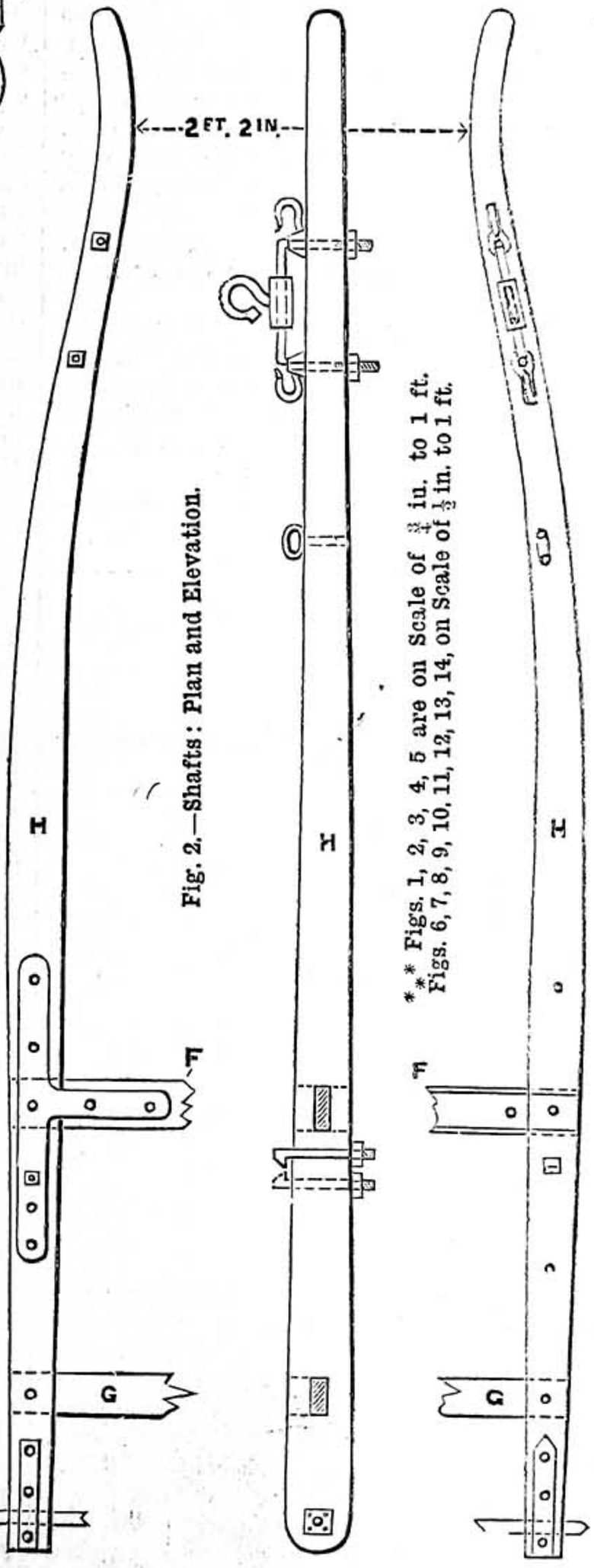


Fig. 2.—Shafts: Plan and Elevation.

*** Figs. 1, 2, 3, 4, 5 are on Scale of $\frac{3}{4}$ in. to 1 ft.
Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14, on Scale of $\frac{1}{2}$ in. to 1 ft.

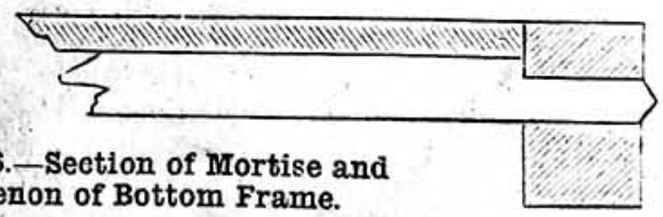
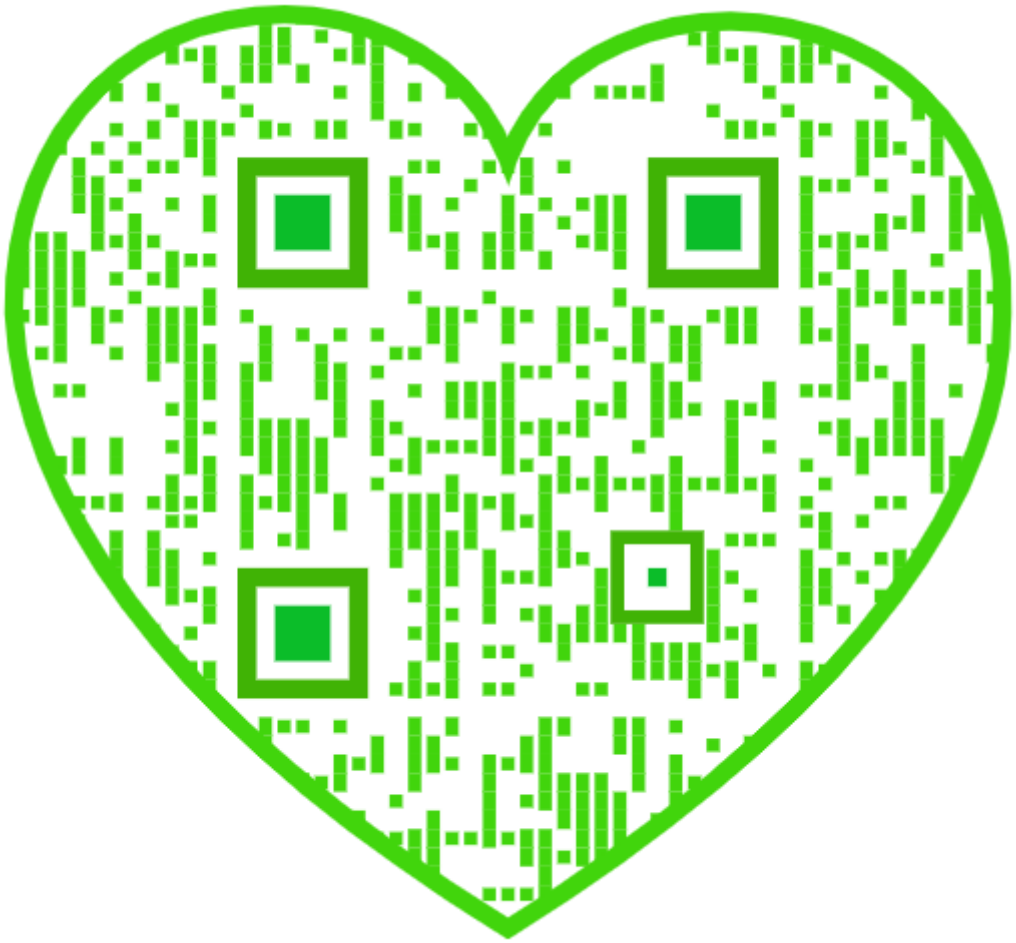


Fig. 6.—Section of Mortise and Tenon of Bottom Frame.

HOW TO MAKE A "TIP" CART.



HOW TO MAKE A "TIP" CART.

BY J. P. S.

VARIOUS NAMES FOR THE "TIP" CART—MATERIALS—QUALITY—BOTTOM FRAME—FRONT BAR—IRONWORK—SHAFTS—BODY—BOTTOM—FRONT—TAILBOARD—BLOCKS—GENERAL HINTS—PAINT.

I CAN well understand many readers of WORK asking, "Who cares to know about that?" My reply to such must be, "A canny Scot." The readers of this journal are a host, and their wants are very varied; not a few of them are anxious to be instructed in making carts and vehicles of many descriptions, and amongst the number is this Scotchman; and as our Editor turns no one empty away, and the space allowable in "Shop" would be inadequate to treat such a subject fully, I am granted leave to put it in a special article as now set before you.

I have given what is known in my neighbourhood, where Scotchmen are fairly numerous, as a "Glasgow" pattern cart. It is fitted so as to empty its load very expeditiously. In "the land o' cakes" it is called a "coupe" cart; in East Anglia similar carts are designated as "tumbrils," but the more general name in trade circulars is "tip" cart.

Materials.—Our first thoughts must be given to materials, and while we are about it we may as well get the whole of the hard wood at one investment; consequently, we will prepare a list to take to the timber merchant. We shall require:—

	Marked	*Length.*	*Depth.*	*Thickness.*
		ft. in.	in.	in.
For sides, 2 pieces of oak	A	6 0	5½	3 (tapered)
For bars, 4 pieces of oak	B	3 8	1½	3¾
For front bar, 1 piece of oak	C	4 8	2¾	3½
For standards, 8 pieces of oak	D	2 0	1¾	2¾
For raves, 2 pieces of ash	E	6 2	1¾	2½
For front shaft bar, 1 piece of ash	F	3 3	3¾	3¾
For hind shaft bar, 1 piece of ash	G	3 3	2	3½
For shafts, 2 pieces of ash	H	9 0	3¾	(tapered)
For tailboard (top), 1 piece of ash	J	5 0	3¾	1½
For tailboard (bottom), 1 piece of ash	K	4 9	3¾	1½
For tailboard (centre), 1 piece of ash	L	4 9	1½	1½
For front top rave, 1 piece of ash	M	5 0	1½	5
For cant piece, 1 piece of ash	N	3 8	3½	2

Also 2 blocks, and a quantity of boarding 1 in. and also ¾ in. thick. The shafts and top rave of the front of body being crooked, templates will be required to saw them out by. These templates should be made of wood at least ⅜ in. in thickness. All the sizes given are "finished" sizes, and the lengths are longer than shown in the drawings, for reasons that will explain themselves as we proceed.

Quality.—The oak must be straight-grained, and free from *large* knots, at all events, and by no means use a piece that contains a bunch of "pin" knots. Timber so embellished looks ornamental while growing, and may answer for building or cabinet-making purposes, where it is not liable to varying loads and sudden strains, but it is wholly unsuitable for cart-building. Nor should the trees be too large or old, as oak loses much of its toughness with age, although—especially when well seasoned—it is often very hard and rigid. For cart-building purposes I prefer oak trees not exceeding 14 or 15 inches in diameter. The remarks as to straightness of grain and freedom from knots refer with equal force to the ash we may require; the shafts especially must be very tough. Much ash is spoilt by being felled after the sap has commenced to rise; it is invariably more or less soft if felled after February 1st, or if steam-dried instead of by the old and slow, but superior, methods used by our grandfathers.

Bottom Frame.—We must commence to erect by planing up the two largest pieces of oak, marked A, and the four pieces for bottom bars, marked B in Fig. 1. The hind edge of the hind bar must be perfectly straight; the other edges of all the others may be planed off to make the bars taper slightly in their width. This will allow our framing to drive together tighter, as well as increasing the strength of the bars in the centre. When the six pieces are true, straight and square, we will proceed to lay them out. We first lay our two pieces of oak side by side on a pair of stools, and proceed to measure off the distances, first of the hind pommels and also of the four bars, putting a short pencil-mark to denote the place of each. Our next proceeding is to consider—Are we going to use an axle which is to be made to order? If so, we can work to the drawing. Or have we bought a new one already finished from the ironmonger? Because in that case we must frame our cart such a width so that the pin-holes for the axle will come in the centre of our oak side pieces. The same holds good if we are using a good second-hand axle. Having settled this important point, we proceed to lay out the frame, bearing in mind *not* to lay the two side pieces parallel, but to make it 1 in. wider behind than in front. This is important, as I once saw a load of wet sand refuse to leave when the cart was "tipped," and consequently a shovel had to be used to unload it. As our cart is narrower in front than behind and our bars are taper, and, moreover, our mortises and tenons must fit very tight, I need scarcely say it is impossible to mark them off with a square and pencil as a joiner would soft wood framing; but instead, the framework must be laid out on the stools, squared with a rod, and the mortises scratched with a pointed piece of steel (a disabled gimlet ground to a point is what we use) in lieu of a lead-pencil. The tenons of the four bottom bars are "fair-faced" from the bottom side, and the shoulder is on the top. This is so done for strength. A tenon and mortise is given in section at Fig. 6. We invariably smooth up such work and drive it together at one operation, but it will be safer for a novice to drive it together in the rough and see that it comes accurate, and knock it to pieces again. Smooth up the bottom bars, and take a chamfer off the bottom edges; round off the rear ends of the sides to form the pommels, and then proceed to drive it together again for the last time, and pin it with oak pins. The ends of the pommels are finished by an iron band being driven on each.

The Front Bar.—We must next take the front bar, C, in hand. It is allowed to project 5½ in. each end to form handles. You will observe the ends are only 2¾ in. square, yet between the two oak sides of the frame it is 3¾ in. wide; the extra width has to be rebated out 1 in. deep to form a support for the front ends of the bottom boards; if the bar was carried through its whole width, it would not only unduly weaken the front end of the sides, but would also look very clumsy. The front bar will require fitting down in its place very exact; and here comes in a reason for our two oak sides being longer than necessary, as, if they were of the exact length, we certainly should break off the two "knucks" were we to drive the front bar into its place as tight as it should be. Perhaps someone will inquire the limits of the tightness allowable. My old master used to carry a piece of broken watch-spring in his waistcoat pocket, and woe betide us if he could insert it into our joints or mortises!

Ironwork.—Having done so much, we can go but little further without the aid of the smith. We shall want eight standard bolts, as at Fig. 9, and two front corner standards, as at Fig. 10. The iron bar across the rear of the body, with its bolts and two mortise holes for the tailboard, may be fitted at this stage, and it will be highly convenient to get the "tipping" bar, the jaws (Fig. 11) that hold it and its spring, and mortise plates at the same time, as they can be fixed in position far more readily now than at a later stage. If we are waiting for the smith, we may get out our eight wood standards, D, which are shown at Fig. 7, but we must not cut the top tenons until the standards are bolted into position and the raves have been marked on. If we are still waiting, we may proceed with the shafts, H.

The Shafts.—The drawings will make these fairly simple, I think. One is given showing the top side and the other shows the bottom; and to prevent any chance of an error, as the materials are costly, I have given an elevation, cutting away the bars to economise room. The hind bar, G, is not so strong as the front, F. The mortises are clearly shown, as is also the ironwork. The front bar has a plate of coach hooping the whole length of its top side, fastened down with wood screws, except the two end holes, which are countersunk for rivets. The underside has two T-plates of iron fastened with four rivets each, as well as wood screws. Each shaft has a band of hooping on its rear end, and the holes for the long pin are protected by plates of iron, as shown. The drawing shows a draught-hook on the slide staple, and also an eye further back; both are not necessary, consequently you are free to choose which you may prefer. The eye gives a steadier draught, in the estimation of many. The shafts being finished, they may be hung, and the irons and bar fixed for "tipping." Both catches are shown in elevation on the same shaft (Fig. 2), but it will be understood that one goes in the near and the other in the off shaft; the drawing is to show their relative *positions*. Having hung the shafts and fixed the "tipping" irons, we may withdraw the long bolt and set the shafts away while we proceed with the body.

The Body.—If the two iron standards are ready, fix them first, and be certain that they are not only the right bevel, both forwards and outwards, but also that they are both fixed alike. The wood standards, D, must next be bevelled to stand at their correct angles, and it will be as well to fit and fix them all in pairs, commencing with the two hindermost, which you will observe are slightly wider than the others. The standards are set out at irregular distances to admit of the bolts escaping contact with the

bottom bars. Be careful not to batter the heads of the standard bolts, or you will disgust your smith, who usually takes pride in finishing them well. When the standards are bolted up tight, the raves may be marked on and mortised, and the tenons cut on the standards. Next fit on the front top bent rave, M (Figs. 3, 4); and when this is done, shave the raves and standards, fix the tailboard irons (Fig. 14) on the rear ends of the raves, and fasten all together very firmly, seeing all is accurate as you proceed step by step.

Bottom.—This had better be next boarded; use good yellow deal or tough elm boarding 1 in. thick. It will lay in the rebate in the front bar, and it will require rebating behind to allow the hind iron bar to lay flush with the top of the boarding. The thin end of the bottom boards is shown in section at Fig. 5. The bottom being securely fixed, and the hind bar also, the sides will be ready for boarding. These boards should also be of good yellow deal or pitch pine, although I have known good Scotch fir to be used with success. The front ends give an opportunity for ornamentation, and the rear ends are protected by a fillet, A, being nailed on the outsides behind the standards. This brings us to the fore ends.

Front.—The cant piece, N, must first be fitted, made the correct bevel, and fixed with strong spikes. Next fit in the outside boards, which must be treated very carefully, or the wood may be spoiled. When fitted, it may be ornamented by cutting out and chamfering as shown in Fig. 4. If preferred, the board may be allowed to remain solid and the effect produced in paint; but for myself, I prefer to cut it out. The inside boards are fixed with the grain running from the top to the bottom, and the lines indicate where the joints may come. All the boarding except the bottom is ¾ in. thick. To prevent any errors in this front I have given a drawing in section, at Fig. 8, of the cant piece, top rave, and boarding.

Tailboard.—This is not double-boarded, or it would be too heavy. The two nib-irons (Fig. 12) on the bottom rail, and the two diamond plates with the pin-holes, are fixed with rivets, or they would soon jar loose. The 1½ in. square strip in the centre is to bind the boarding and make it more rigid.

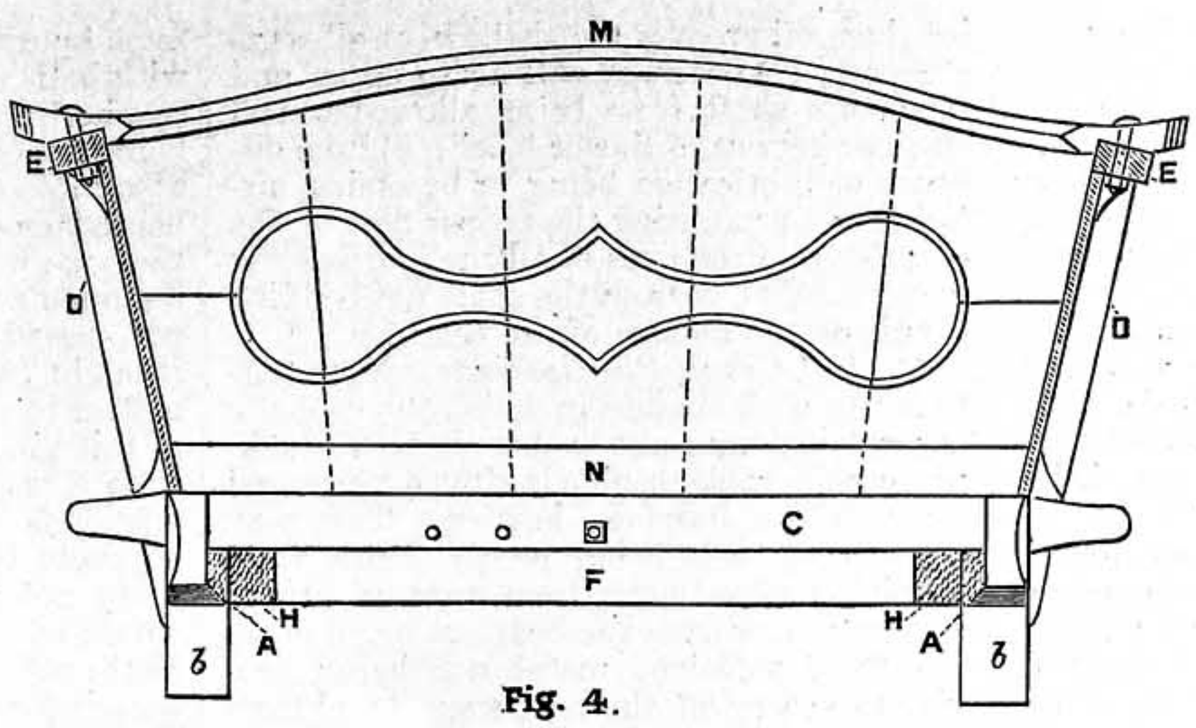


Fig. 4.

Fig. 4.—Front of Body of "Tip" Cart: Elevation.

The keys are fixed to the tailboard with small chains and staples, and in my drawing at Fig. 5 the tailboard is cut away to show the square line that gives the bevel of the cart.

Blocks.—These remain to be fixed, and the holes bored for the long axle-pins (Fig. 13). Two iron plates may be spiked to the blocks, *b*, to keep grit from working into the rear of the axle. The arms of the axle are 2½ in. in diameter. The wheels are 4 ft. 4 in. high and the tires 4 in. wide. To a "Southerner" the front rave bands are very hideous, but they are the joy of the soul of a Scotch smith.

General Hints.—Much more instruction may often be given in the same space by drawings than by words: consequently, I fear I have given what may be considered an excess of drawings. I trust they may tell their own tale. I have endeavoured to help a young farmer, say, who has not had a training, and wishes to make a cart without spoiling his materials. Again, the strength of all vehicles largely depends on a judicious blending of wood and iron; bearing this in mind, I have given shore stays and bottom stays at the hind corners. I may remark loose top-boards are sometimes added, 7 in. deep, all round the body. If desirable, they may form the subject for a future paper. I may add another word which is highly important. It is this: all the mortises and tenons should be put together, and all the ironwork painted, where it comes in contact with wood, with white lead, made into a smooth soft paste by the addition of equal parts of raw oil and turps. The pins holding all the mortises down on the tenons should be made of tough oak, and driven in with the white-lead lubricant. In no case can wedges be allowed; they are certain to shake out.

Paint.—The wheels, bottom and inside of body, the shafts, and also the ornamental space in front, are all finished red. For the remainder green is the favourite colour. The ironwork is finished a deep *blue-black*, and so forms a relief and looks well.

If readers wish to know anything which may not be quite clear, inquire through "Shop"; it is always open, and I am yours to command.

ENGINE AND BOILER MANAGEMENT.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.,

Author of "A Handbook for Steam Users," "Wood-working Machinery," "Stone-working Machinery," "Pumps and Pumping," etc.

ENGINES.

POUNDING OR KNOCKING OF ENGINES—ENGINE CYLINDERS CRACKING—QUICK METHODS OF SETTING A SLIDE-VALVE—HOT BEARINGS—HOT CRANK PIN BEARINGS.

I NOW bring to a conclusion my remarks on this important subject. For preceding papers the reader is referred to pages 229, 290, and 354.

40. *Pounding or Knocking of Engines.*—Pounding or knocking may arise from a variety of causes. If the knocking is at the end of the stroke when the crank is on the "dead centre," it may arise from wear on the connecting-rod bearings, or from their not being keyed up tight enough, or from the piston-rings being broken too loose at the guide-bar end, or from a ridge or inequalities in the cylinder or guide-bars. Knocking, when the crank is at half-stroke, will not be caused by any of the above reasons except the piston or piston-rings being loose, which

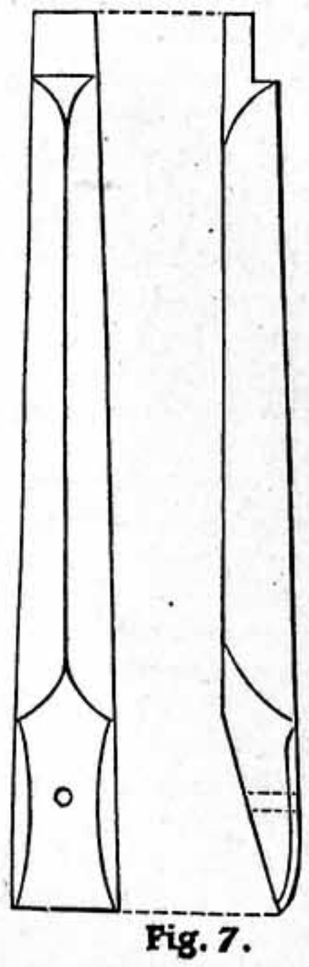


Fig. 7.

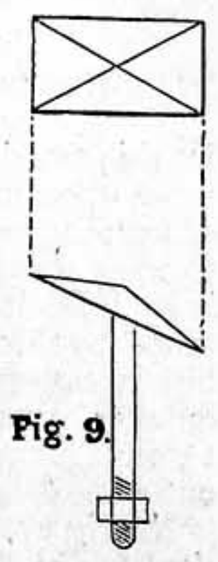


Fig. 9.

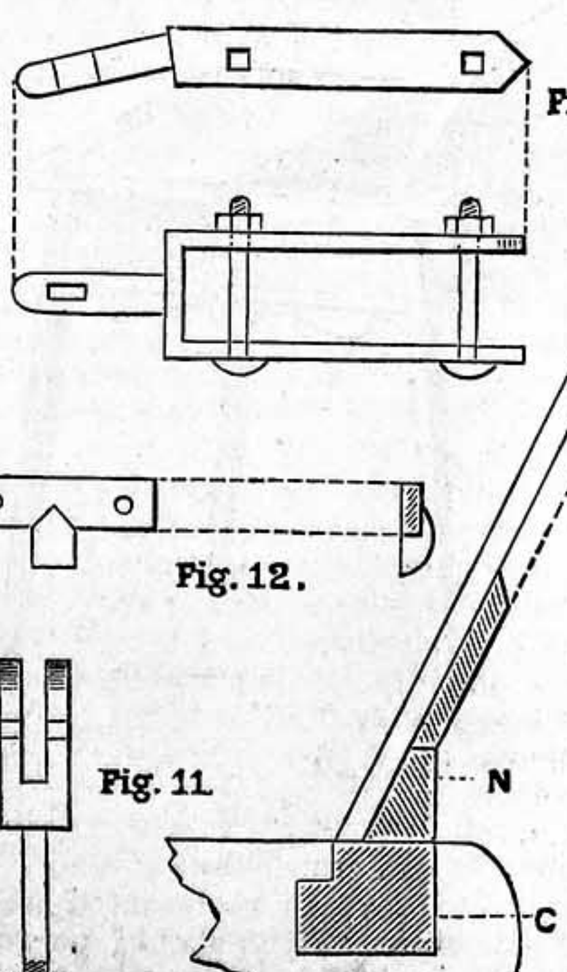


Fig. 8.

Fig. 14.

Fig. 12.

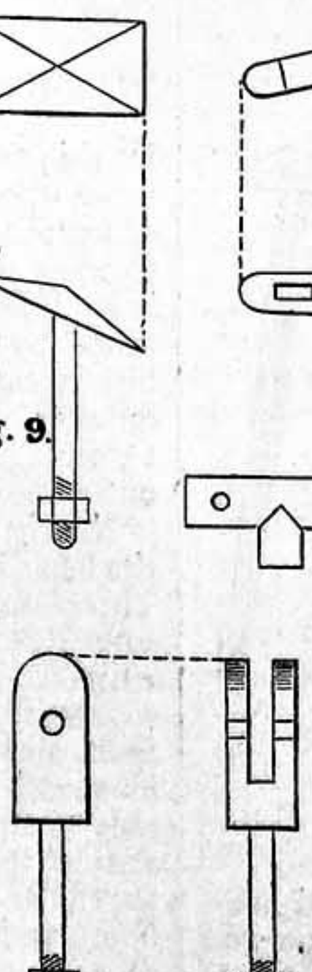


Fig. 11.

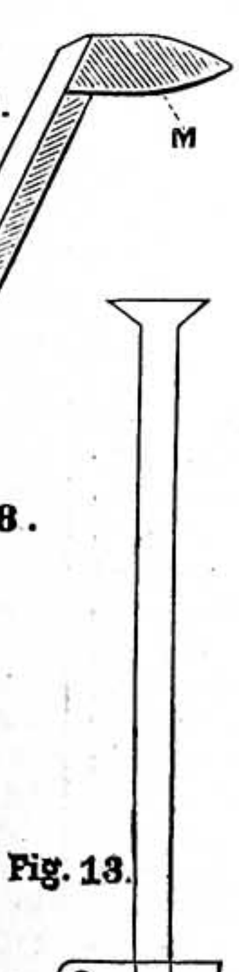


Fig. 13.

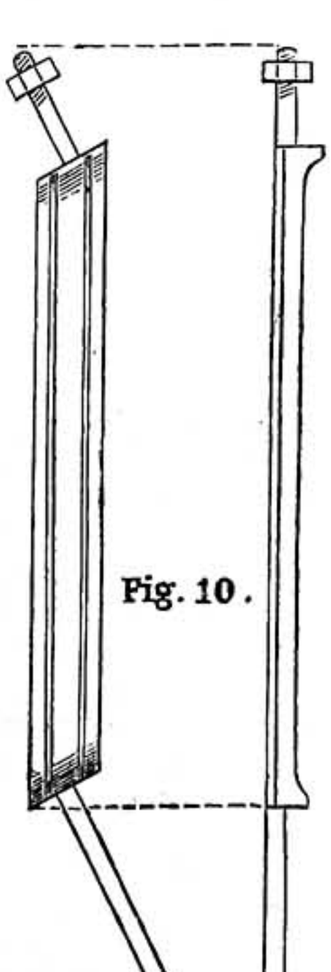


Fig. 10.

Fig. 7.—Standards: Wood. Fig. 8.—Section of Front, showing Manner of fixing Boarding. Fig. 9.—Standard Bolts. Fig. 10.—Front Corner Standards: Iron. Fig. 11.—Jaws for holding Tipping Bar. Fig. 12.—Nib-Irons for Tailboard. Fig. 13.—Axle-Pins. Fig. 14.—Rave-Irons to hold Tailboard.

would cause a knocking sound as the crank came over the dead centre and at the end of each stroke. Knocking or clicking of piston-rings may also be caused through water being in the cylinder, either from the boiler priming or from condensation of steam. It may also arise from the engine-shaft, cross-head, or slides being out of line, or from insufficient cushioning of the piston, or from a slack nut at the end of the slide-valve rod, or valve rod bent from an accumulation of dirt. Knocking may also be caused from the axes of all the journals not being parallel.

41. *Engine Cylinders Cracking.*—There is little doubt that the "mysterious" cracking of engine cylinders which occasionally occurs arises in many cases from the want of ordinary precautions on the part of the driver. Drivers often get up steam and start their engines as soon as possible, and the steam is let into the cylinder when it is cold, consequently an immense strain from sudden and unequal expansion is set up. It is, therefore, advisable, especially with large engines—more particularly in frosty weather or exposed situations—that the cylinder be thoroughly warmed before starting. There are, of course, other reasons for cylinders cracking: such as the use of improper or unsound metal in their construction, improper proportion of metal, water or ice in the cylinder, broken piston, engine running away, etc. The cylinder, if steam-jacketed or not, should in all cases be carefully covered with a good non-conducting material to prevent radiation of heat.

42. *Quick Methods of Setting a Slide-Valve.*—(1) Make the eccentric-rod of such a length as will permit the valve to open equally at both ends of the stroke. Then put the crank on the dead centre, and turn the eccentric round the same way as the engine is intended to go, altering until the valve moves through a distance sufficient to give the required lead, and you may rely on its being the same on the opposite side. (2) Another plan (Dunn). Remove lid from steam-chest, revolve the main shaft or slack the set screws in eccentric, and revolve eccentric until full throw of same is made in one direction, opening the port to its largest size. Now make a tapered wedge out of a lath and slip it down in open port, marking with a knife or pencil the edge of wedge on valve-seat. Now revolve eccentric until full throw is made towards opposite end of steam-chest, and until port is open to its largest size; then slip the wedge down in port as before; then with a rule divide the distance between the two lines on edge of wedge, marking a third line in the centre; then, with the eccentric at full throw, lengthen or shorten the cam-rod until the wedge, with its centre line, fits one port neatly, and it will fit the other one as neatly when full throw is made in the opposite direction. Now place your engine on a centre, and revolve eccentric until the port over the end of cylinder, in which the follower is placed, has opened about $\frac{1}{16}$ in., and tighten your set screws. This done, your slide-valve, also your eccentric, is properly adjusted, and no time wasted in hunting dead-centre or chalk-marking fly-wheels.

43. *Hot Bearings.*—Heated bearings may arise from a variety of causes: such as (1) Bearings of insufficient area for the pressure or strain put on them; (2) engine running at short centres with a tight belt; (3) bad-fitting or seamy shaft; (4) bearings screwed up too tight; (5) insufficient lubrication, improper or bad oil; (6) dust or dirt in the bearings, oil-grooves too shallow, or oil-ways stopped; (7) bearings will also stretch and pinch the shaft from being allowed to run slack or get out of line or level; (8) from oil-boxes or lubricators being or becoming air-tight, and preventing the proper flow of the oil; (9) from the axes of all the journals not being parallel, or from the shaft not bedding evenly on the bottom of the bearings.

44. *Hot Crank-Pin Bearings.*—More particularly with engines in which the connecting-rod is arranged to work on to a crank-pin, considerable trouble is often experienced through the bearings heating. This may arise from their being poorly fitted, from requiring adjustment, from want of proper lubrication, or from the bearings being made too thin, sufficient metal not being provided to carry off the heat engendered from working when the bearing was slightly out of order. Apparently well-fitted bearings may heat from another cause, and one that has puzzled a good many in detecting, and that is from the connecting-rod being out of line. To detect this, take the connecting-rod out of the cross-head and key it up tightly on the crank-pin. Now move the rod up and down, and see that it drops truly into the bearing on the cross-head; if it does not, you will know it is out of line, and should be overhauled and adjusted at once, as the bearing will never run cool under these conditions, it being very much strained, and the area in contact with the crank-pin being largely reduced. If, on examination, you find the bearings are wearing bell-mouthed, you may conclude it arises from the last-mentioned cause. A similar trouble may arise with engines in which a sweep-crank is used, but it is not so pronounced.

A BOX-TOP TABLE.

BY JAMES SCOTT.

During a stroll lately among the London streets, the shops in which teem with high-class furniture of every description, my attention was directed to a table similar

A Box-Top Table.

in appearance to the one represented here. Of the utility of it no one should possess one particle of doubt, for it must be apparent in plain boldness that an article of this kind can be used as a storehouse for oddments and small knick-knacks which may be deemed indispensable, although troublesome by reason of their smallness. Again, with both wings or flaps opened, allowed to rest horizontally, the under surfaces of them being uppermost, the article could be used as a tea-table, the area of the flaps, when opened, being almost as large as when closed over the box; while, in addition, the cavity would be found suitable for the reception of tea-pot, bread-tray, sugar-basin, etc. Indeed, it might be considered a very advantageous matter to adapt the table solely to purposes of this kind, and, constructing the article in such a way that the capacity of the box portion is sufficient, store all accommodating adjuncts to a tea-meal within the interior when not required for use. Of course, it would be a source of inconvenience to use a cloth with which to cover the table, as occasion might frequently arise for application to the box; but a well-polished or prettily enamelled piece of furniture has no need of being hidden under any sort of cloth.

It may be noticed that there is so little extra labour necessary to construct the table as a box article than would be required to make it in the ordinary way, that it ought not to call forth any objections in this direction; while it must be admitted that the box answers all the facilities of a drawer without necessitating the extra work of making one.

The reader is requested to note that the narrow end top pieces, to which are attached the flaps that form the table-top, must be fastened to the framework of the table.

Some readers may remember (or if they will refer they will see) that I gave a similar suggestion to that contained in this table in reply to a correspondent in page 653, Supplement, No. 92, Vol. II. (issue for December 20, 1890), in the upper portion of a tool-chest. Whether the present article is adapted from my idea in that number I cannot positively say, for it is impossible to keep pace with all fresh improvements; but certainly I can say that on my part originality, and not copying, was foremost. The flaps, as an alternative, could be hinged as shown in the number of Work quoted.

BOOT AND SHOE REPAIRING.

BY W. GREENFIELD.

Half-Heeling—A Novel Way to Keep the Heels Level.

In this article of our series I want to impress upon my readers the great importance of keeping heels level, for if they are allowed to wear down low, the ill that is caused by it is difficult to remedy. For it not only tends to throw the heel itself on one side, but it causes the sole to wear away much quicker, runs the stiffener down at G G (Fig. 1), and generally throws the boot or shoe out of position beyond recovery.

Nearly everybody in walking wears down the heels of their boots at one particular spot. This should be most at A (Fig. 1), though with some it happens right at the back of the heel, while a few wear most on the inside. Now, to repair these defects is nearly one of the best jobs that a novice can start upon, inasmuch as the grafting in half-heeling only means butting the new piece of leather against the old, as there is no play or friction to cause them to come asunder. In the boots and shoes that are manufactured now so very cheaply the leather is not what is called "properly worked"—that is, as I have previously mentioned, "wetted, dried, hammered," etc.). This causes what I daresay most of you have experienced—namely, a

new pair of boots worn out in the wet are, when taken off the feet, lower on one side of the heel than the other, although the leather is not actually worn away. This is because it yields to the pressure and weight of the body in walking, and the yielding is their first step to ruin.

To prevent this, when you buy new boots always ask them to put a few extra nails just round the part where you know you wear most. When the heel is only worn down on one side it is not necessary to take the whole of the top piece off, but only half of it, which can be replaced with any hard corner of sole leather that would otherwise be almost useless.

To do this, saw the top piece across at B C, and should the lift be worn, saw or cut that through as well at D E; tack a piece of leather on to take the place of the worn piece of lift, putting the tacks in at F and F. Then trim it round, and put some odd hard corner of sole leather on in a like manner, to take the place of the worn part of the top piece. Trim this up also, and nail as shown in Fig. 2. In this case you will need to put four of the rivets in, quite ¾ in. long, at A, B, C, and D, so as to hold the lift as well as the top piece. Of course, you can put one, two, three, or four rows, as you please, but they are not much use unless they are close together; and two rivets should be put in, one on each side, as shown at E, F, G, and H. This done, file them up, and finish in the ordinary way.

Now, as I have said above, it is all important to keep the heels level. You will not be surprised, I hope, that I have tried to gain or obtain this desideratum with the idea (simple as it may appear) that it is of great importance to those who mend and study their own boots.

Certainly, half-heeling, with plenty of nails close together, and regularly done, will keep them in proper order; but everyone cannot always spare their boots or spare the time to do them properly in this way, and it is a job that, once started, the boots cannot be worn again until they are finished. Hence the need of a method that is either quicker or that can, in some way or other, be more divided.

Now, the best thing is never to wear a top piece quite through, for you touch the lift if you do; and, no matter how little this may be, it will need either replacing as described above, or repairing by means of a skiver put under.

But, prior to letting them wear away, take a piece of paper with one straight side and lay this across the heel, from J to H, Fig. 2; hold it with two fingers of the left hand quite firm at F and G; then with the right hand smooth it down over the edge from J, passing A, B, C, and D on to I. This will leave a mark on the paper; cut it out to this mark, and it will give you a good pattern of a half-heel piece, as Fig. 3, without the outside line A. To this you can cut another pattern out of stiff cardboard, as you will want to use it very often.

This done, and you have any more leisure, cut a piece of sole leather out to this pattern, leaving ¼ in. on all round the curved side A, Fig. 3—this to give room for nailing. But before I show how this should be done it will be necessary to explain how to make a certain awl for this purpose. They cannot be bought, like all other awls, ready for use, but as it is a tool that saves much time and disappointment, I will describe how it can be made, and also a suitable handle for it.

Now, to make this tool you want, first of all, an ordinary peg-awl handle, as A, Fig. 4, and put two pieces of sole leather on top, as B and C. To secure these, put one short stout screw in the centre, and then put a third piece on, as D, first cutting a hole in the centre, a little larger than the head of the screw, as A, Fig. 5, and then put about five rivets in, as B, C, D, E, and F. This is done because the awl, when finished, is very stumpy, and requires such hard blows to get it in that it would split the wood, and by this means you throw all force on the leather, and the hole in the centre will admit of tightening the screw when necessary. This done, and the edge trimmed up all round, put into the other end a carpenter's large bradawl. This kind of awl, as most people know, has a square shoulder to it, therefore the heavy blows will not drive it up into the handle. When the awl has been put into the handle, break it off to about an inch of the shoulder; then with a fine file, or on a grindstone, if you have one, taper it to a long, flat, square point, as E, Fig. 4; in fact, it should be just the size and shape of a French brad, only about ¼ in. longer, and, of course, smooth.

The piece of leather in Fig. 3 should be of good substance, and should be wet, but not soddened; then mark a line round the curved side from B to C, ¼ in. from the edge, and from these two points make two rows of holes with the new awl, which should, by the way, be dipped each time before using into a piece of soap. A hole can be missed in the second line of holes at each of the four places D, D, D, D, and a small round hole made instead; and four more also made at E, E, E, E, and then let the leather get nearly dry, that you may hammer it as before explained.

This will make the holes smaller and look more irregular, as shown in Fig. 3; but that does not matter so long as the awl was held in the same position for each hole, for the brads are sure to follow into their proper place.

I said above that the awl should be of the same shape as a French brad, which is as B in Fig. 6; but there is another kind of brad the same shape, only it is much shorter and a little stouter, as A in Fig. 6. These are called cut-bills, and it is this brad you must use to put into the holes made in Fig. 3. Let the length be as near the substance of the leather as possible, knock them in the square holes one at a time, and when they are all in take the leather off the wood (the best thing to do the bradding on), and lay it on the lap-iron with the points of the brads upwards. These, if they are not too far through, can be clenched and made smooth by tapping down with a hammer, but if they are through far they must be cut off with a pair of cutting tongs close to the leather before trying to clench them.

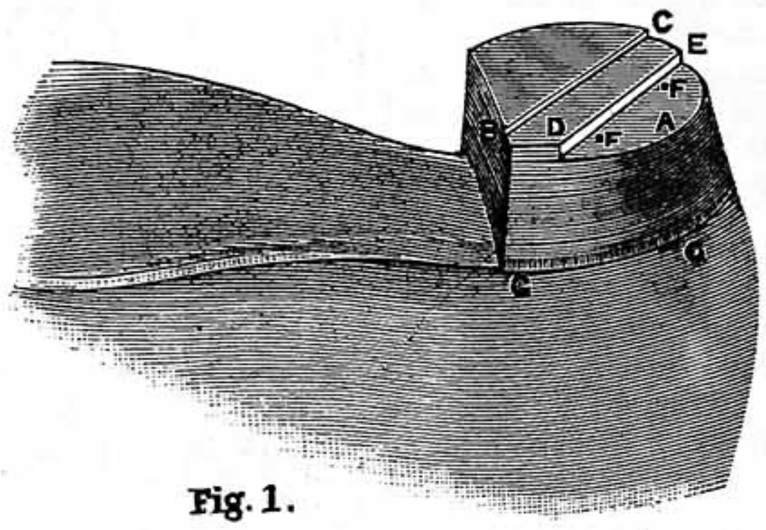
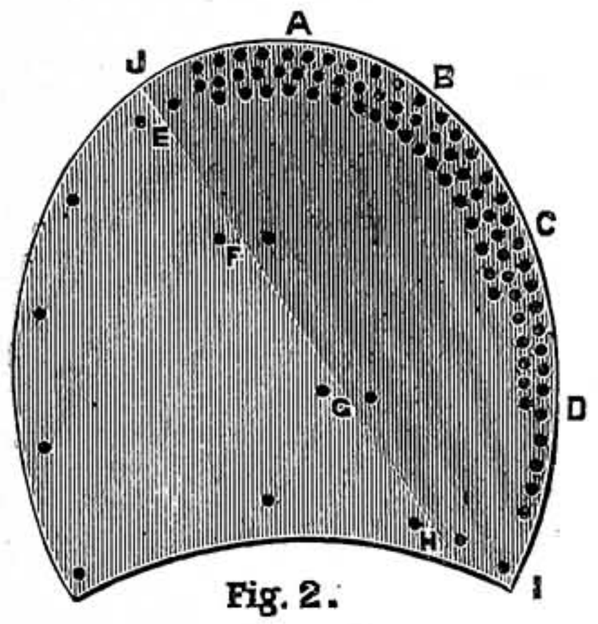


Fig. 1.



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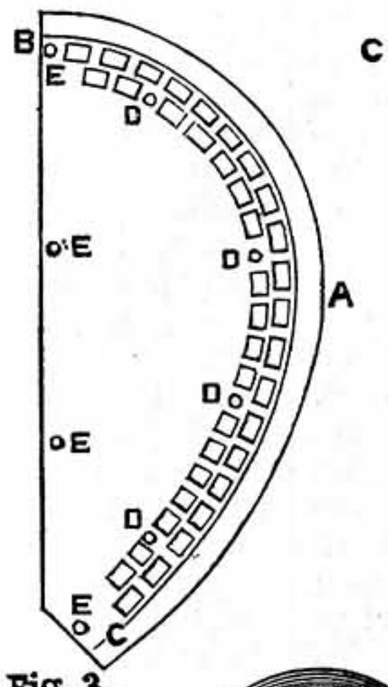

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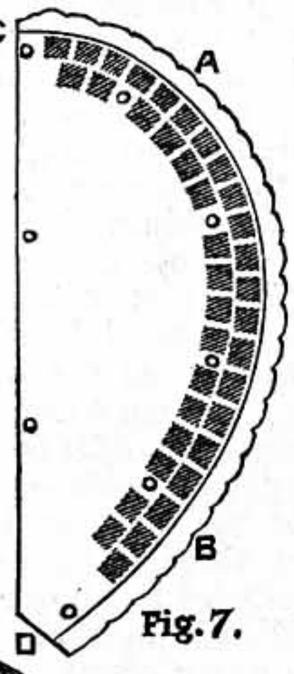


Fig. 7.

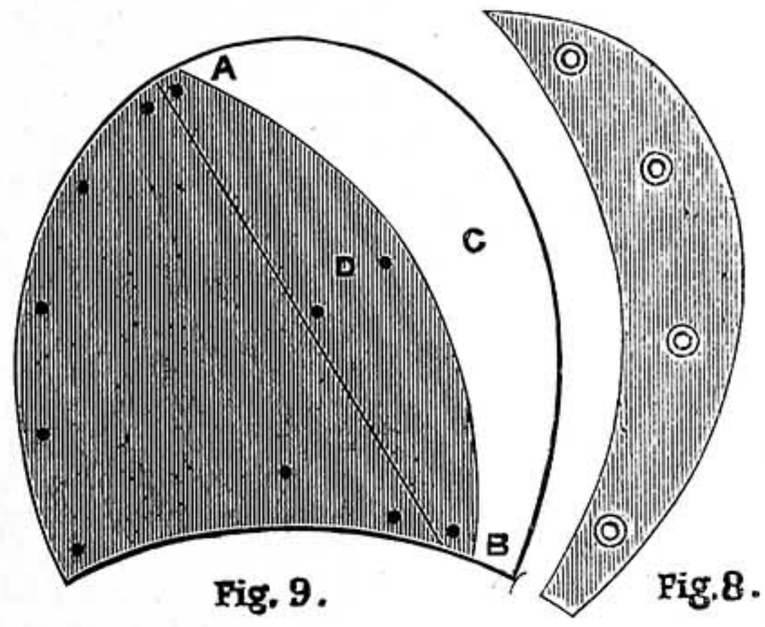
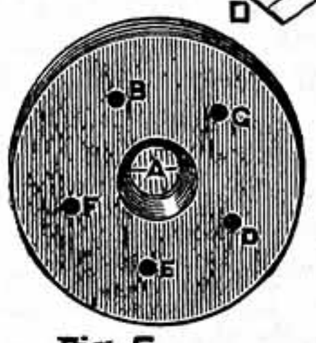


Fig. 9.

Fig. 8.



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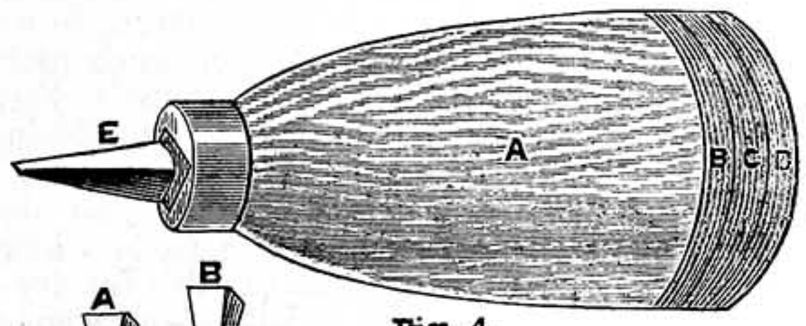


Fig. 4.

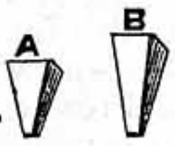


Fig. 6.

Fig. 1.—Heel with Worn Part of Lift and Top Piece cut away to receive Piece Lift and Half-Heel. Fig. 2.—Top Piece levelled by Half-Heeling, with three Rows of Rivets close together to resist wear. Fig. 3.—Half-Heel Piece holed and hammered. Fig. 4.—Home-made Awl and Handle. Fig. 5.—Top of Awl Handle with Hole through Centre. Fig. 6.—A, Cut-bill; B, French Brad. Fig. 7.—Half-Heel Piece bradded, ready for future use. Fig. 8.—Snow's Patent Leather-Plugged Half-Tip. Fig. 9.—Top of Heel, showing how to fit for Half-Tip.

This done, they are ready for use, and you can keep as many prepared as you wish, and all that is necessary then to half-heel the boots is to cut the top piece across, as shown, from J to H, Fig. 2, take the worn part away, and replace it with the new piece (Fig. 7), which shows the way it should be bradded, and also the eight places for a like number of $\frac{5}{8}$ in. rivets, which is all that is necessary to hold it on, and will let it be taken off easily when another piece is wanted on.

It will be found that the small margin, A B, Fig. 7, after the brads have been put in, has become somewhat contracted. This is why the extra $\frac{1}{4}$ in. is left on, for if nailed close to the edge the leather would break out, whereas now you can trim up the edge of the piece to the edge of the heel, cutting right close to the brads, as the line C to D, and finish in the ordinary way.

It will be necessary to put four rivets in the old leather at E, F, G, and H, Fig. 2, the first time they are half-heeled, to keep it from ripping off.

Another good and easy way is to get a pair of Snow's patent leather-plugged half-tips (Fig. 8), price 1½d. Put it on the heel in its proper position, and mark round the inside from A to B, Fig. 9, and cut that part away that the tip is going to replace, as C. Lay the tip on the lap-iron face down, and tap it in the centre, that it may grip well at both ends, then just dip it in water to soften the leather plugs, and put it on the heel; with a fine awl make a hole through the centre of each plug, and put a long rivet (which they should give with the tips) in each hole; file it up anywhere where rough, and you have a new lease of heel wear for 1½d., and a very little trouble.

Should you find it difficult to cut the curved line to fit the tip from A and B, cut it straight across, as you did in Fig. 2, from J to H, and after the tip is on cut a small piece, as D, Fig, 9, and nail it in with four rivets.

To get D the proper shape, let it have one straight side, press that against the old leather, and hammer the new on the tip. This will make a mark underneath: cut through this line, and you have the shape required.

FRENCH POLISHING—"DRY-SHINING."

BY DAVID DENNING.

EMPLOYMENT—METHOD OF WORKING.

THE ordinary methods of French polishing having been fully described, the novice who has managed to do "bodying up" and "spiriting off," or even "glazing," will find the operation of "dry-shining," which is the subject of the present article, mere child's play in comparison.

From this remark it must not be understood that dry-shining can be done "right off the reel" by the novice, for, like everything else in polishing, it requires attention and a certain degree of skill, though not by any means to the same extent as spiriting off. It is not, however, like glazing, in some degree a substitute for that difficult process; and those who may think that they can get a high degree of finish on their work by means of dry-shining it may as well give up the illusion at once. If a really good finish is wanted, French polish, as it is ordinarily understood by members of the craft, must be done, for there is no efficient substitute with which a like result can be got. What, then, is dry-shining, and what is it used for?

Well, let the latter part of the question be answered first. It is useful for finishing inside work—such as the insides of boxes, drawers, cabinets, and interior parts generally—and is often seen on the fronts of drawers and trays enclosed in a wardrobe. In fact, it can be used in any position where a high degree of finish is not necessary or customary. The chief advantages in connection with it are that it can be done expeditiously, and therefore cheaply; that it sufficiently closes the grain of the wood to prevent dust getting in and clogging it up; and lastly, it gives a degree of finish which wood left "in the white" or altogether unpolished does not possess.

Now, to answer the question as to what dry-shining is, shall we add how it is done? Roughly speaking, it is the nearest approach to varnishing by means of a rubber, instead of a brush, that polishers practise with ordinary French polish. The wood, if it may be so said, is varnished with this, applied by means of the polisher's special appliance—the rubber. In practice, dry-shining is done almost as bodying in, or, to be more accurate, is bodied-in work finished as in glazing, but with French polish used instead of glaze.

The wood is bodied in without any preparatory filling, but otherwise precisely in the ordinary manner, as directed in a previous article. It is not, however, customary to take such precautions to get up a good body as was then recommended; in fact, bodying up for dry-shining is somewhat of a misnomer as the work is generally done. A better idea would almost be conveyed by saying that the wood is wiped over with the polish rubber, as not much trouble is usually taken to do more than get the preliminary body worked on. Of course, something in this respect depends on the position of the part and the class of work being "dry-shined," for there is no reason why the first body should not be allowed to sink, and then be re-bodied if necessary. To do much bodying in, however, would make the amount of work almost equal to that involved by ordinary French polishing, so that ordinarily dry-shining is practised as stated. When a superior finish is wanted, there is, of course, no objection to French polishing the parts which have been mentioned as suitable for dry-shining. Beyond the fact that this answers well enough, there is no practical reason, except that it is less costly, why it is adopted.

When the bodying up, then, has been done to the satisfaction of the polisher, it only remains to finish it. To do this, the rubber is charged with French polish: if anything, rather more fully than was recommended for bodying, and instead of being rubbed all over the wood in any direction, is wiped over in the direction of the grain from end to end of the piece, very much in the same manner as was mentioned in connection with glazing. The rubber may be moved backwards and forwards till dry, if desired, but a better way under ordinary circumstances is to let the polish deposited by each rub dry before going over the same place again. When using the rubber in finishing, it should have no oil; and, if the former of these two methods is done, it will be difficult to prevent the polish dragging, so that the easier course may as well be adopted.

This method of finishing work—viz., by dry-shining, which, by the way, is a technical expression seldom heard outside the workshop, as to the general public it is included in the general term of French polishing—is the crudest and simplest way in which a gloss can be got on the surface of wood by means of a thin varnish of shellac and methylated spirit. It must not be mistaken for varnishing, as this process is ordinarily understood, for it is distinctly a French polishing one.

SOMETHING ABOUT THE "PUFFS" OF A LOCOMOTIVE.

BY P. H. D.

THERE must be something strangely attractive and wonderful about the "puffs or beats of the exhaust" of a locomotive, as they are the first to attract the attention of a speechless baby when taken by rail, and it generally shows its joy and surprise by smiling, and trying to reach them with its tiny hand. But I am sorry to say that, as the majority of these children grow up, their curiosity gradually subsides, though to anyone interested there is a great deal to be learnt therefrom. How many of the thousands of passengers who daily make use of the railways in and about London, if asked, "How many puffs does a locomotive emit when travelling a given distance?" could give even a suitable answer, by which the problem could be solved correctly? Yet, while waiting on the platforms, each person sees on an average twenty trains daily, entering and departing, and no curiosity seems to be aroused in their minds, which I can only account for by the very familiarity of the object. Probably, a few remarks will not be uninteresting to those readers who are fond of railways, and all things appertaining to them.

I will first endeavour to answer the question in the foregoing paragraph. The number of "exhausts" emitted by an engine are proportionate to the number of revolutions of the driving-wheels, and not, as some people suppose, more numerous when running at a greater speed than when covering the same distance slowly—that is to say, the same engine would exhaust the same number of times in travelling twenty miles, whether it moved slowly or quickly. Of course, the quicker the speed the quicker the exhaust, but then the engine gets over the ground at a proportionately increased speed.

The number of "exhausts" emitted by an ordinary locomotive is four for every revolution of the driving-wheel, and these can be easily counted when an engine is leaving a station with a good heavy load, as it moves slowly, and the "puffs" are distinct, and take place as the crank-pin passes the right, upper, left, and lower centres. As an example, I will take a Midland express engine, and work out the number of "puffs" it emits in going a given distance. We will take the run from London (St. Pancras) to Leicester, 100 miles (99¼ miles is the correct distance, but for simplicity we will take the former figure). The diameter of the driving-wheel is about 7 feet: this, multiplied by 3·1415, will give us the circumference, which comes to nearly 22 ft., which we will consider as correct. Now, if we divide 100 miles (the distance traversed) by 22 ft. (the circumference of driving-wheel), we shall get the number of revolutions of the main-wheel in running this distance. There are 528,000 ft. in 100 miles: this, divided by 22, gives 24,000 as the number of revolutions. Now, as there are four "puffs" to each revolution, 24,000 by 4 will give us the number of "puffs" in running 100 miles, which amounts to 96,000. The express trains

are allowed a little over two hours to do this journey, but I have a record before me which gives the details of a fine run by the Scotch express from Leicester to London on April 28th, in which the whole journey was accomplished in 1 hour and 46 minutes, or at an average rate of nearly 57 miles an hour. This was an altogether exceptional run. So we will allow two hours for the journey, when we shall find that the number of "puffs" per hour is 48,000, or an average of 800 per minute.

Edinburgh is 400 miles from King's Cross, so that an engine with the same size of driving-wheel as just mentioned would give a grand total of 384,000 "puffs" in accomplishing that distance.

There are, however, some express engines, termed "compounds," which, with the same diameter of driving-wheel as above-mentioned, would only give one-half the number of "puffs" in going the same distance. Such engines are to be met with on the North Eastern, but the principal railway employing them is the London and North Western, on which there are a great number in general use. The reason the number of "puffs" is diminished is that the steam, after having done its work in the high-pressure cylinder or cylinders, instead of blowing out into the air, passes into a larger one, and the steam is only allowed to escape into the air after having done its work there, so there are only the two exhausts from this one cylinder, instead of four from two cylinders, as in the preceding cases.

The size of driving-wheels, as a great many readers will know, depends on the kind of traffic to be dealt with. If the engines are to start quickly and pull a good load, as in the suburban passenger traffic at certain times of the day, the wheels are reduced in size, and often two or more are coupled together, till the extreme is found in the goods engines, which have the smallest wheels, and generally six of them are coupled together, as they have to draw heavy loads at a medium pace.

The exhaust is also a good indicator of the setting of the valves. If the "puffs" come regularly and clearly, then we know that the valves are correct; on the contrary, should the "puffs" be irregular, then the presumption is that the valves are wrong in some way, and the defect should be corrected.

There are very few persons who cannot tell when a locomotive is pulling a good load, and still very few would be able to say on what they base their opinion. In most of the cases it would be from the great noise made by the exhaust steam escaping in such quantities from the chimney.

Another peculiarity is that the exhaust steam issuing from the chimney emits quite different sounds on the several lines, which is accounted for by the difference in the tastes and ideas of the various locomotive engineers of the different lines. If you were to listen attentively and frequently, you could very easily distinguish some of the railways by this means, as the variation of sound in the exhaust is very marked. Again, in others, this difference is very slight. A great many engineers would be able to tell to what line a locomotive belonged, simply by the sound of the exhaust alone, without seeing it.

I hope these few remarks will be serviceable to someone among the many readers of this paper, as I think the study of the subject will be interesting. Like many other things, much may be learnt from it if properly investigated.

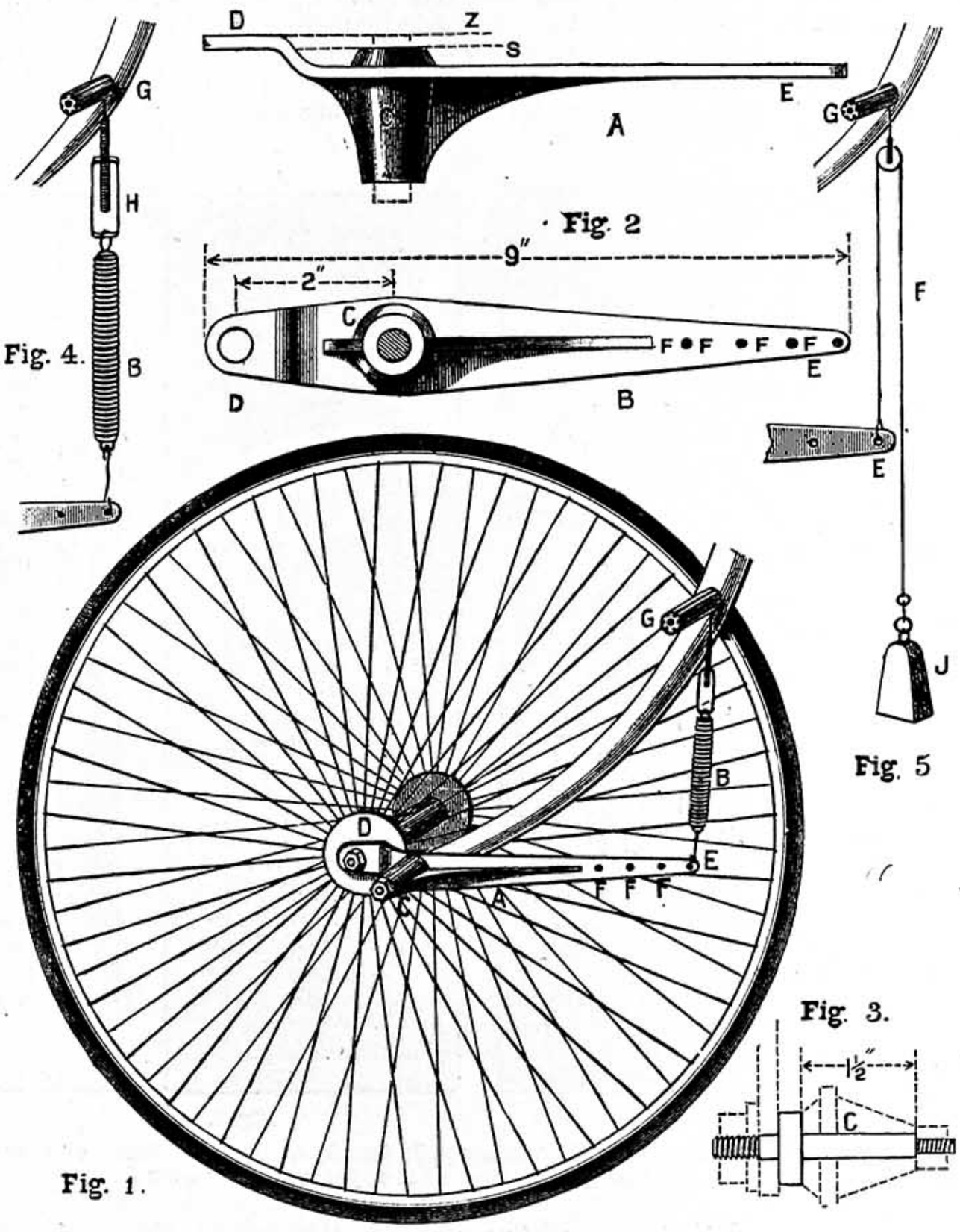


Fig. 4. Fig. 2. Fig. 5

Fig. 1.

Fig. 3.

Fig. 1.—Bicycle Wheel fitted with Anti-Vibrator. Fig. 2.—Lever—A, Side View; B, Plan. Fig. 3.—Form of Spindle. Fig. 4.—Attachment of Spring to Lever and Foot-Rest. Fig. 5.—Diagram showing how to determine Tension of Spring.

A SIMPLE ANTI-VIBRATOR FOR BICYCLES.

BY CYCLOPS.

EVEN though it may be late in the cycling season, there may be many readers of this paper who will be thinking of "going in" for a machine, or who, having an old one, feel inclined for a change.

One of the first questions which will occupy their minds is what kind of a machine they intend to ride.

Those whose pockets are minus the useful metal will look with envy on the purchasers of cushion or pneumatic-tired machines, and many of these have been in use this season.

The tire question is the all-absorbing subject of talk and discussion in cycling circles, and no doubt most of the machines sold this year will be fitted with one or the other of these luxuriant appliances.

To the attention of those readers of WORK who are not in a position to purchase new machines this paper is especially directed, and the anti-vibrator which the writer is about to describe is one which may go a long way towards making up for the want of a cushioned tire.

As will be seen from a glance at Fig. 1, the appliance consists essentially of a lever, A, and a spring, B, which so act on the wheel and frame as to intercept any vibration which may be caused by rough roads.

The spindle carrying the long bearing, C, of the lever, A, is attached to the end of the fork by a nut and washer in the same manner as the wheel spindle was attached to it. The wheel spindle is attached to the end of the lever by its own uts and washers in the same way as it was attached to the fork ends.

The lever, A, moves on the long bearing, C, and the spring, B, keeps it in place until some obstacle is encountered, when the wheel, in jumping over it, forces down the end, E, of the lever, and expands the spring, B, which thus takes the vibration which would otherwise be conveyed by the rigid fork to the rider.

A reference to A, in Fig. 2, will show the form of the lever, which will be best made of malleable iron. The pattern for casting will be exactly of the form of the lever itself, except it is intended to turn out the bearing, C, to fit its spindle, in which case the hole through the boss, C, being small, need not be made by prints, but be drilled from the solid. It will, of course, be understood that all parts are in duplicate, there being one for each side of the wheel. The side view of the lever is shown at B, in Fig. 2; the holes shown at F, F, F, F, are for the hook end of the spring, and can be bored in the lever after casting. The width between the lines S and Z, in A, Fig. 2, will have to be the same as the thickness of the spindle collar and fork-end. This will be obvious after consideration. By making both top and bottom half of the lever of the same form, only one pattern will be required for the two, which will be an advantage.

The form of the spindle on which the long bearing oscillates is shown at Fig. 3. The spindle should be made of forged steel, turned up and screwed to fit its nuts and the long bearing.

The dotted lines in Fig. 3 show the nuts, washers, fork-end, and long bearing.

The spring, B, is attached to the lever, A, and the foot-rest, G, by hooks, as shown in

Fig. 4, the screw joint, H, being to regulate the tension of the spring. These hooks should be closed when the spring has been satisfactorily fixed. The tension of the spring can be determined by attaching weights at J, as shown in Fig. 5, by means of a cord passing over a pulley temporarily attached to the foot-rest, G.

When the weight of the rider balances properly with the weights at J, the reader will know that this is the weight required for the tension of the spring. This spring can be obtained of any spring maker by sending particulars of the tension, length, and thickness required. If any difficulty is experienced in obtaining this spring, a question in "Shop" will elicit the required information.

Cyclists will find that this little appliance, when fixed to their machines, will amply repay the trouble of making, besides giving the satisfaction of knowing that it is of their own manufacture.

The writer has made one and fixed it to his machine (a "Premier"), with the result that the vibration, especially on the arms and hands, is minimised to an extent which will hardly be credited, and he can, therefore, offer these suggestions to readers with the satisfaction of knowing that they will amply repay the labour expended, and that they may be instrumental in overcoming the difficulties encountered by many country cyclists by reason of rough and ill-kept roads.

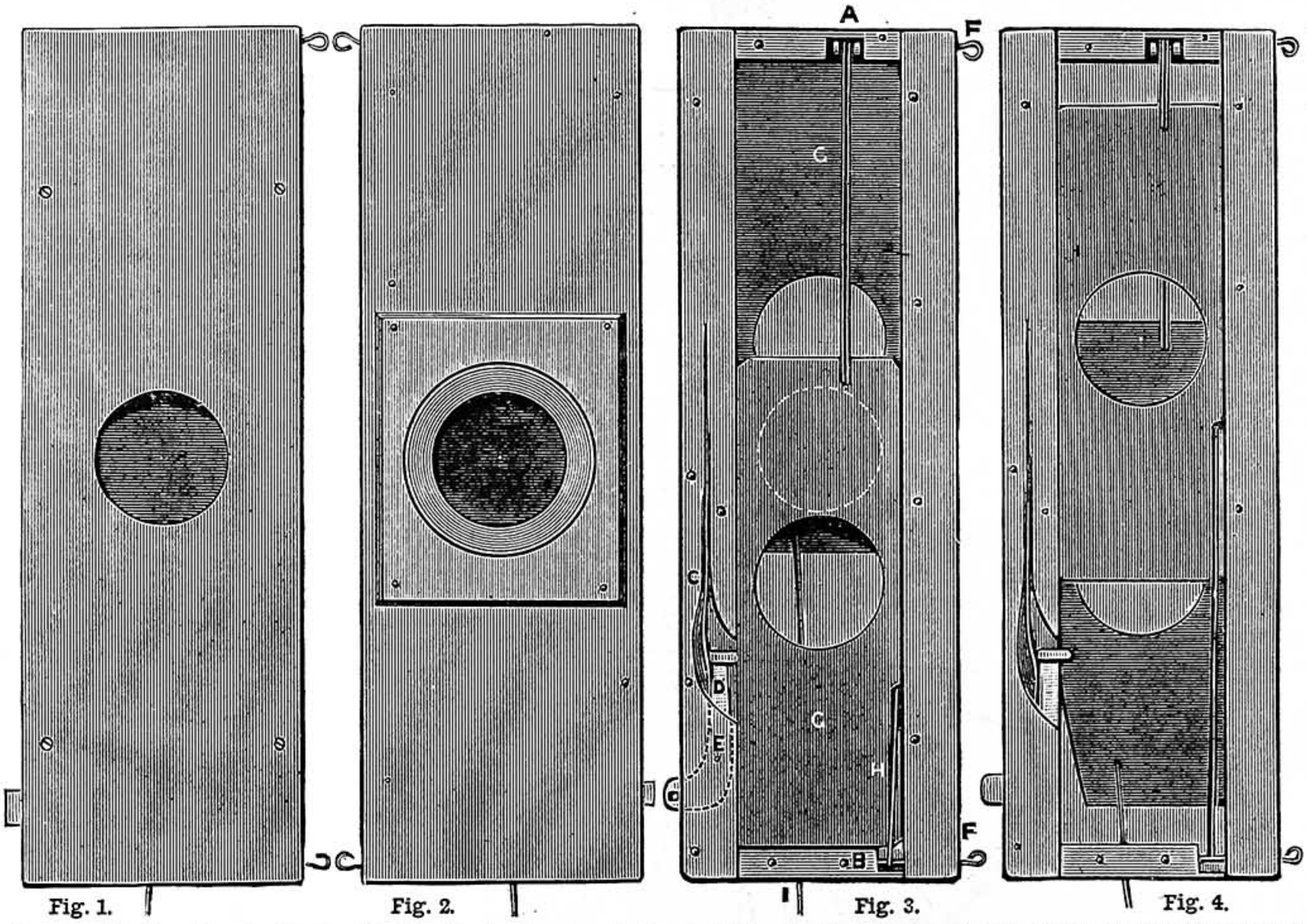


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Fig. 1.—Shutter Front. Fig. 2.—Shutter Back, showing Collar to fit Lens Tube. Fig. 3.—Inside of Shutter as it appears after Exposure. Fig. 4.—Inside of Shutter as it appears when set for Exposure.

AN EASILY-MADE INSTANTANEOUS SHUTTER.

BY FRANK S. MORTON.

EVERYONE who practises photography as a pastime, and many who do it as a business, have more or less occasion to use an instantaneous shutter. There are shutters complicated and shutters simple for all uses, and one of the principal requisites in their make-up is a certainty of action and a lack of jarring propensities, together with a method of regulating their speed for slow or fast exposures. To be complete, they must also be constructed so as time exposures can be made with them readily. An instantaneous exposure can be made with the very simplest arrangement, all that is required, of course, being a couple of pieces of wood with a hole in each, so arranged that one piece is attached to the lens tube and the other is slipped or dropped by it, so that when the two holes are opposite the exposure is made. But a shutter having all the qualities above mentioned must needs be a little more elaborate in its construction. A shutter possessing all these qualifications, and one which can be made at home by anyone, is shown in Fig. 1, the illustration being about half-size. But very little work is required other than can be done with the very simplest of tools, and if rightly made its action is certain and sure, its operation accompanied with not the slightest jar, and the regulating of the speed but the work of a moment. I can best tell how it is made by describing the one made by myself, and I will try and make my description clear, so that those readers of WORK who desire to do so can make one like it with no more difficulty than I had.

I first cut out two pieces of thin wood, $\frac{1}{8}$ in. thick and $2\frac{1}{2}$ in. by $7\frac{3}{4}$ in. Exactly in the centre of each I cut a hole 1 in. in diameter. I used a fret-saw, but careful work with a sharp pocket-knife will answer the same purpose. Of wood $\frac{3}{16}$ in. thick I cut pieces $\frac{1}{2}$ in. wide for the sides and $\frac{1}{4}$ in. wide for the ends, to form a box which, when put together, would be $\frac{3}{16}$ in. deep inside, $1\frac{1}{2}$ in. wide, and $7\frac{1}{4}$ in. long. Before tacking these side and end pieces in place, they were fitted for the working parts as follows:—The two end pieces were notched as shown in Fig. 3 at A and B—at A to allow room for a small brass pulley to run in, and at B in which to fasten a rubber band. The brass pulley may be omitted if too much trouble to make it, as the strings will work all right over the plain wire. The pulley makes things run easier, however. One side piece was cut with a fret-saw, as shown at C, and another cut was made through it at right angles with this, in which the brass catch, D, was to work on the pivot, E. This catch was made of sheet brass of the shape shown by the dotted lines, and had a piece of thicker brass soldered on the end which engages the shutter flap. It is held against the flap, and pressed into the notch at the right moment by the thin brass spring above it. This part of the shutter was all placed in working order before the side piece was nailed to the back; then the side and end pieces were nailed in place, and holes bored for the wires, F, F, to run in. These wires were allowed to project from the outside, to allow of more easy adjustment. Next, the two flaps, G, G, were made. These were made of thin hard rubber, but, of course, any similar material can be used. They were made $4\frac{1}{4}$ in. by $1\frac{1}{2}$ in., with a 1 in. hole in the centre of each. Notches were cut in the edge of one for the catch and the other for the rubber bands, and holes for the cords by which they are worked. To ascertain where these notches were to be cut, one of the flaps was placed in the bottom of the casing and pushed towards the end where the catch was located until the hole in the casing was well covered by the flap. Where the catch was, there the notch was cut The corner of this flap was trimmed off so as to pass by the catch smoothly without interfering with it. A small but stout string was then fastened to a hole in the other end of the flaps, and passed up under and over the brass pulley and back to the second flap, now laid in place, and tied there. In the tying of this string, care should be taken that when it is stretched taut the holes in the flap and the outer cases are exactly coincident. It requires patience to get them so, but the successful working of the shutter depends upon it. Now, from the notch in the top flap stretch a small elastic band, as at H, down to the notch in the end pieces at B, and slip in the wire to hold it in place. In the illustration but one notch is shown, but, to change the speed, have several cut along the edge, so as to give more or less stretch to the elastic, and, consequently, faster or slower working of the flaps. Different lengths and sizes of rubber bands can also be used for the same purpose. A string running from the under flap down through a hole in the end completed the arrangement, and the top was screwed in place. A collar to fit the lens tube was cut out and attached to the back, as in Fig. 2. To set the shutter, pull the string, I, until the catch, D, engages with the notch in the edge of the flap. To release it, press the projecting part

of the catch, which releases the flap, and the two are pulled rapidly past each other by the rubber band, and the exposure is made. Fig. 4 shows the shutter set for exposure, and Fig. 3 shows it after exposure is made. As the two flaps are pulled in opposite directions, they counteract any jar, and the camera is not moved a particle. Time exposures are made the same as the shutter is set for instantaneous. Pull the string until the shutter is open and hold as long as necessary, and then pull out until it catches. A little French polish puts a nice finish on the outside. Being light and of the right shape, the shutter can be easily carried in the pocket.

I have myself found this kind of instantaneous shutter extremely useful, and without doubt it will prove equally useful to such readers of WORK as may be induced to make it and try it. It is possible that some may think the mention and description of a home-made appliance such as this unnecessary, on the ground that articles of this kind are sufficiently numerous, and are to be acquired at no great outlay. This is true, without doubt, but it must always be borne in mind that there is, generally speaking, far more pleasure in using any article, be it what it may, that one has made than one that has been acquired by purchase; and then, again, there are many who are compelled to look twice at a shilling before they part with it, and that to such as these, the instructions given will be of importance.

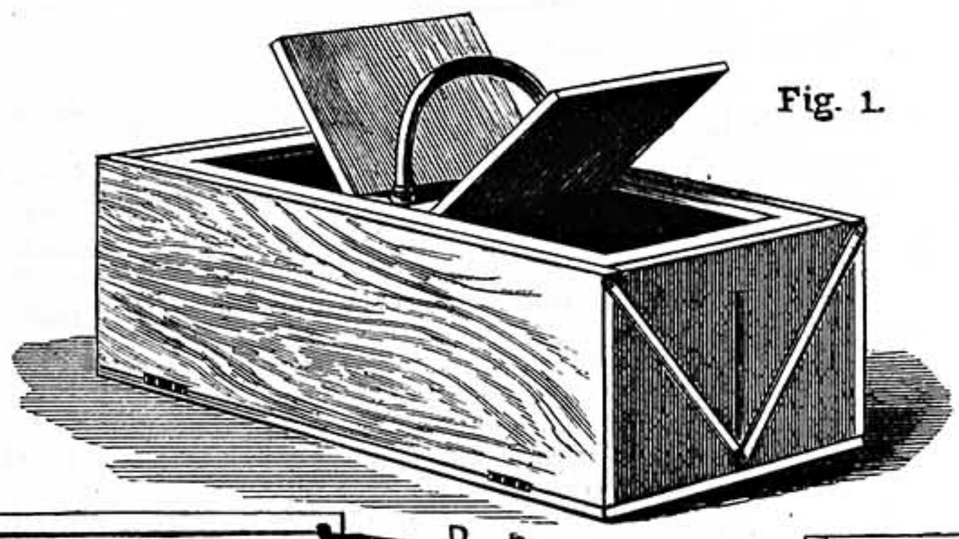


Fig. 1.

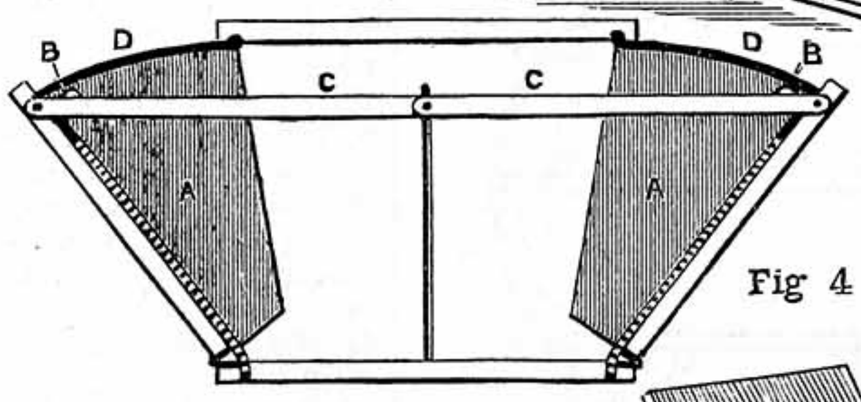


Fig 4

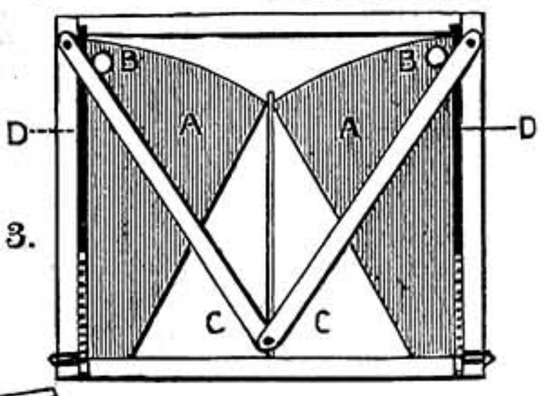


Fig. 3.

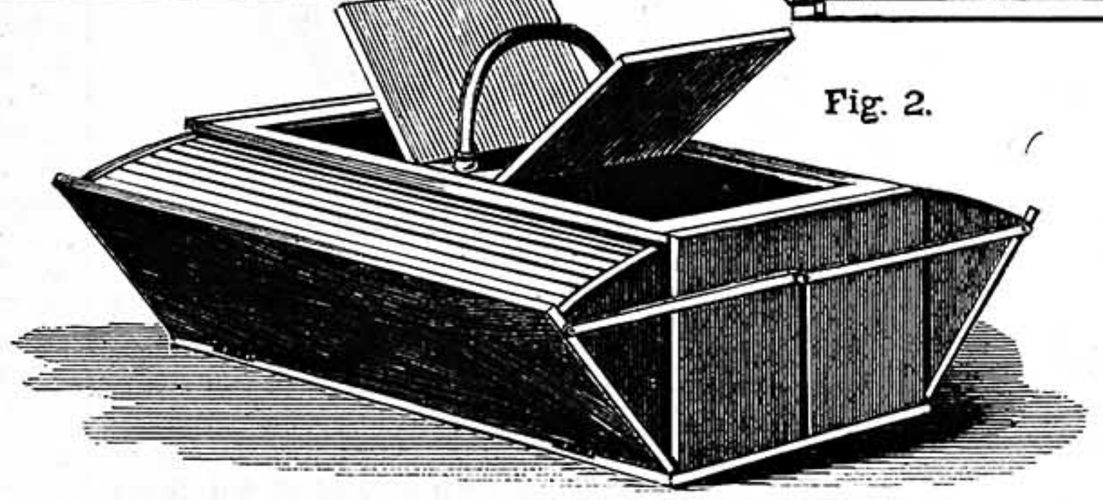


Fig. 2.

Fig. 1.—Casket with Lids open. Fig. 2.—Casket with Sides expanded. Fig. 3.—End Elevation of Fig. 1. Fig. 4.—Side Elevation of Fig. 2—A, A, A, A, Boards attached to Side Boards of Casket; B, B, Rods between Opposite Pairs of Boards; C, C, Movable Side Rails; D, D, Section of Laths to cover extra Openings. Dotted Lines connected with the last-named represent Elastic.

AN EXPANDING TRAVELLING OR SHOPPING CASKET.

BY JAMES SCOTT.

ITS OBJECT — EXTRA AVAILABLE SPACE — CONSTRUCTION — THE BODY OF ARTICLE—ADJUSTING BARS—COVERINGS FOR EXTRA OPENINGS.

Its Object. — The members of the working portion of the British community have a notable relish for partaking in excursions to the country or seaside which begin and terminate in a single day, and whilst travelling among them during a journey, it will be seen that there is sufficient evidence forthcoming to warrant the conclusion that working men (and women) lose not one atom of their appetites on such occasions. Sandwiches and bottled beer for the support and stimulation of the adults; sweets, cakes, and tarts for the delight of the youngsters: these constitute a large proportion of the contents of their bags, baskets, etc. And who shall say that these self-same bags, baskets, etc., shall return empty in their owner's possession? Toys, shells, and anything pretty, useful, or memorable, are, if opportunity offers for their security, concealed within them until home is reached.

This being so, it is impossible to say with certainty whether *paterfamilias* will be acting correctly by taking in his custody the market basket, or box, or other receptacle, seeing that to determine whether it will chance to be sufficiently large or not for the purpose may be a difficult task, and to take one of dimensions too bulky to carry about conveniently during the day is not desired.

Under these circumstances, then, a casket, box, or whatever else it may be termed, should be welcomed on numerous occasions as affording means of conveying, either there or back, eatables, drinkables, breakables, etc., the quantity of which may accumulate beyond expectation.

When once I see an ingenious idea embodied in an article of practical utility, and am convinced that that idea enhances that utility, I carry it in my memory. Thus, when my attention was drawn to a representation in a London tradesman's catalogue of a novel form of wicker-work basket, whose sides could be lowered outwards, and whose upright corner edges were covered with silk to prevent any article within from falling out, I decided to remember it; and although I am not by any means barren of original ideas, I fail to see any weak spot within which any reader may reasonably insert the wedge of disapproval in my determination to embody that idea, in a different form, for the use of whomsoever may consider it to contain any merit.

It was while working out a novel form of screen for my readers that I hit upon an arrangement whereby an expanding box might be constructed which could be adjustable to and fixable at any degree of openness within its extreme. That arrangement is shown in the sketches. To have silk or other fabric attached to the corners of a four-side dropping box would hardly be compatible with the rough usage such an article as this would be called upon to undergo; and in the original basket, so far as I could understand it, it must be either in its closed condition or opened to the extreme.

For shopping, too, my working friends might find the casket useful, for the cry would not then be, when the "missus" besought her husband to purchase a few luxuries on Saturday night, "Oh, let it be now; the basket's full"; as the "missus" would retaliate by condemning him for not making an expanding article.

Let us see where extended utility steps in by adopting this suggestion. Presuming that the proportions of the article are always as in Fig. 1, more commodities might be purchased than it would hold; and supposing that it were always as shown in Fig. 2, and that but few articles were purchased: in the former case an extra parcel would have to be carried, and in the latter a bulkier receptacle than required. The difference, then, is struck by having it to expand. This will be much better than carrying two boxes or baskets on the chance of filling both or one and a half.

Extra Available Space.—A glance at the drawings will show that the extra space available will be in area about equal to half of that contained within the article when in its smallest compass; in other words, the box is adjustable to an extent almost half as large again as itself, as shown in Fig. 1.

Construction.—It is time now that the details are dealt with. Before beginning, however, with them, let me tell my readers that the size of the article is purely a matter of personal consideration; and I shall say no more about this part than to add that the shallower and longer it is made the better, provided sufficient room is allowed for the play of the movable side rails. There is no need to advance reasons for these conclusions; the reader must trust my assertion.

The Body of Article.—A bottom board, two sides, and two ends will be required, all to be fitted in such a manner that the surfaces of the upright boards will be flush with the edges of the bottom board, and the end edges of the side boards flush with the surfaces of the end boards. Permanently join the ends to the bottom board and hinge the sides to the same. Fit a frame, having a middle cross rail, between the ends at the top. On each side of the middle cross rail hinge a lid as shown. To the inner side of each side board join a board of the shape A (Figs. 3 and 4) to it at each end, permitting it to work alongside the inner surface of the end board to which it is adjacent. Of the form of handle to be attached to the top I shall say nothing, leaving its choice to the reader's discretion.

The Adjusting Bars.—The adjusting bars, which open the two sides of the box to an equal extent, and can be used to retain them at any desired angle within the extreme limit, should consist of a pair of thin rails pivoted at their outer end to the edges of the side boards, and having a hole at each opposite end, through both of which will pass a small thumb-screw, the latter being connected with a nut on the inside of the

casket. A narrow slot should be cut in the end board, to allow of the free play of the thumb-screw. It will be obvious to those who give it a thought that the thumb-screws may be either loosened to permit the rails to work upwards and downwards, or tightened on to the nut to retain them in any desired position. I advise the use of a pair of rails and screw and nut on each side of the box, although not really essential.

Coverings for Extra Openings.—The detail which now remains for consideration is that of the covering of the extra openings. It should be plain to all that solid wood tops will be comparatively useless, by reason of acting as obstacles in the way of easy communication with the interior of the case.

After due attention, I have decided that very narrow laths glued to canvas and travelling along the inner surfaces of boards, A, A, A, A, will be the best for our purpose. To the under surface of the top framing securely fasten the upper lath (all of the laths combined should be just sufficient to cover the openings), and carry them over a rod (B, Figs. 3 and 4) fixed between the movable parts, A (of which I have not previously spoken). Attach two or more pieces of stout elastic to the lower edge of it, and finally fasten the remaining ends, without stretching it, to the bottom board. This completes the constructive details.

It may be preferred to discard the laths for some reason or another; if this is so, it will only be necessary to substitute some such material as leather-cloth in place of canvas and laths, and attach it in precisely the same manner as that described in connection with the laths.

I have studied simplicity of appearance for the purpose of making clear the movements of the article, and also to leave free scope for the imagination of my readers to add ornamentation in whichever shape or form they prefer.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

60.—THE COPUS-BOOTH "IDEAL" PATENT CASTOR.

VERY recently two kinds of castors that seemed to present certain advantages have been noticed in WORK. Here is yet another—the Copus-Booth "Ideal" Patent Castor, which is manufactured in all sizes and forms, plain and ornamental, by the patentee, Mr. Cyrus Copus, 22, Clapham Road, London, S.W., who will send a price list to any applicant, and will show it in action, affixed to tables and chairs, etc., to anyone who may wish to see it. The construction of the castor is very simple, as may be seen from Fig. 1, which shows a plate castor, to be screwed on to the bottom of the leg of any piece of furniture, but the principle is the same in this as in socket castors and any other form. From a horizontal plate at the bottom of a hollow cup, two ears or lugs project, through which an axis—also horizontal—is passed. This axis also passes through a ball, which forms the castor, revolving, *but in one direction only*, on the axis. Now it will seem somewhat strange to some readers that a castor which is an axle castor, and which will run only in a direction at right angles to its axis, should work satisfactorily when attached to furniture of any kind. The utility and good service of the castor depend entirely on the way in which the castor is fixed; and this

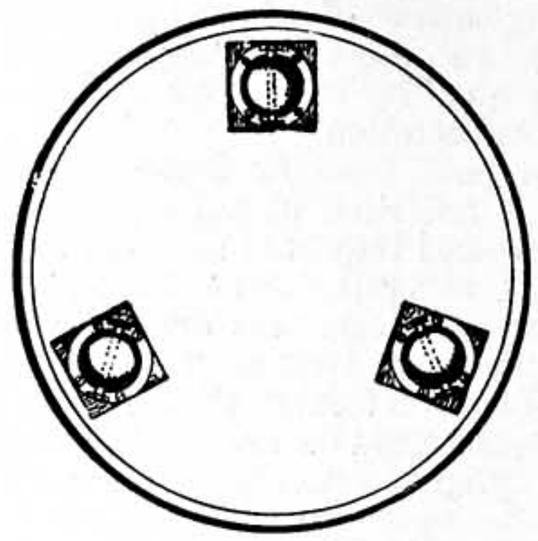


Fig. 2.—Mode of fixing Castors on Round Table.

must be done in a particular way, and generally in a different way, for different pieces of furniture. On looking at Fig. 2, showing how to fix the castors to a round table, it will be seen that the axes of the castors, shown by dotted lines, all point to a vertical line dropped from the centre

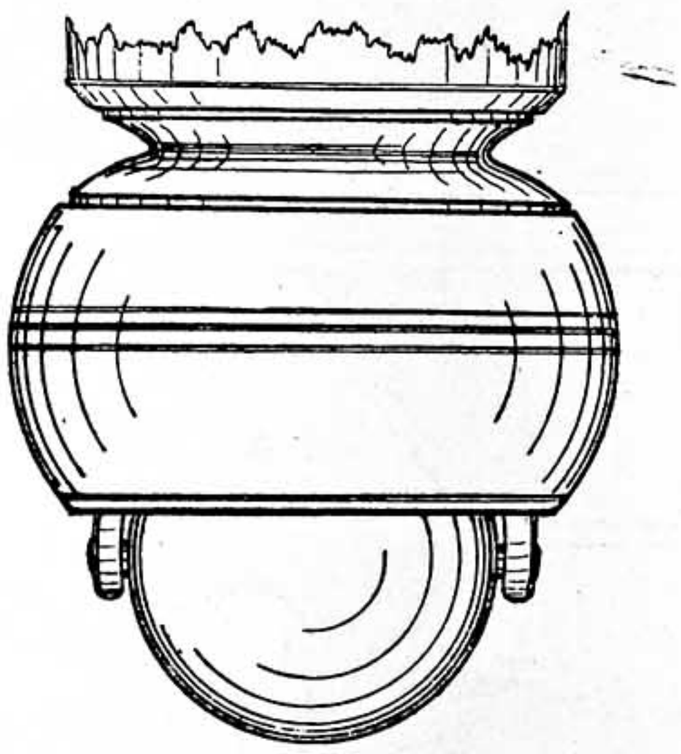


Fig. 1.—The Copus-Booth "Ideal" Patent Castor.

of the table; and in Fig. 3, showing castors fixed to a single chair, the axes of the front castors are parallel to the edge of the front of the chair, and the axes of those behind are at an angle of 45° or thereabouts with it. The proper way of fixing for any piece of furniture is shown in the

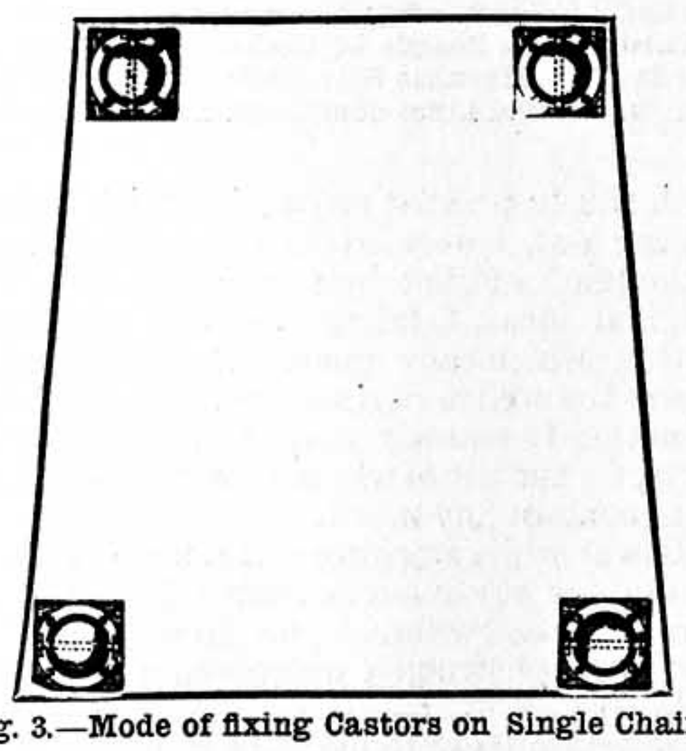


Fig. 3.—Mode of fixing Castors on Single Chairs.

price list issued by Mr. Copus. The prices per set of four range from 8d. to 6s. 6d., according to size and make. I have much pleasure in saying that the "Ideal" Patent Castor is by far the best thing of the kind I have ever yet seen, and should be—as it doubtless will be—in use in every house all the world over. THE EDITOR.

SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

WATERPROOF CLOTH.—Despite the almost universal use of indiarubber material for waterproof coats and leggings on the part of landsmen, sailors—and, we may add, experienced travellers—still adhere to the more lasting, if cumbrous, fabrics composed of calico or similar material, submitted to a process in which rubber finds no place. This results from two reasons: one, that the beautiful light cloths produced by the rubber factories will not stand much wear and tear; and the other, that a hot climate deteriorates them rapidly, however well faced they may be. A third reason is, of course, the price demanded for really good waterproofs. Many people, moreover, are anxious to know how to make waterproof cloth for purposes other than clothing—such as light tents, awnings, etc. It may, therefore, be useful to state that the best material for both uses is strong grey or twilled calico, made up into the garments, if for wear; or kept in the piece, if for conversion into awnings, etc. When a more substantial cloth is required—such as for travelling tents, etc.—a light canvas may be used, one number lighter than that usually supplied. The cloth being ready, it should be thoroughly dipped in bullock's blood until well saturated, and then hung out to dry in a strong current of air. When perfectly dry, the cloth should be slightly worked with the hands, so as to soften it. Then take ordinary linseed oil and litharge, in the proportion of twenty parts of oil to one of litharge, and mix thoroughly, applying this to the prepared cloth. Repeat the coating twice or thrice, as seems necessary, allowing each coat to dry thoroughly before the next one is applied; but do not expose to the sun. When completed, the cloth will be thoroughly waterproof.

AQUARIUM CEMENT.—A good many of our readers take an interest in aquariums; and how to cement the glass sides in an absolutely waterproof manner is, to many, an unsolved problem. Most of the recipes given, although of easy application by manufacturers, are by no means available to amateurs. The latter may be glad to know that twenty-five parts of gutta-percha, carefully melted, seventy-five parts of ground pumice-stone, and one hundred parts of Burgundy pitch, all mixed and melted together, form the best known cement for the purpose. A little deftness in applying (after the fashion of puttying glass in an ordinary window-frame) is necessary; but once properly in place, it forms a leak-defying cement.

GUTTA-PERCHA SUBSTITUTE.—The growing want of a substitute for gutta-percha is evidenced by the fact that the Société d'Encouragement pour l'Industrie Nationale, of Paris, is offering a prize of 3,000 francs for the discovery of a substance even partially taking its place. Failing this, the prizes will be awarded to anyone giving the most practical hints upon the cultivation of the gutta tree. A second prize of 2,000 francs will be given for the best device for measuring the insulation of the various portions of an electrical plant while the current is passing. The substitute for which the first prize is offered may be natural or artificial. Communications must be sent before the end of November, 1892, to 44, Rue des Rennes, Paris.

WANTS.—Amongst the various articles which are advertised for in the technical journals as desiderata are a good process for the Recovery of the Precious Metals, a New Lock, an Improvement in Wood Flooring, and an Improved Brick- and Tile-Making Machine. One would almost imagine that practical finality, in some of these at least, had been reached. But there is evidently scope for inventive genius in directions not apparent to superficial observers. To our minds, the most obvious want of the day in domestic matters is an *absolutely* safe and cheap paraffin lamp. Its principal desiderata are—a provision against any rise in temperature in the oil reservoir, and its immediate extinction when upset. Such lamps can be bought, but the price of present patterns is prohibitive.

SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

II.—Questions Answered by Editor and Staff.

China and Glass Drills.—W. J. C. (*Jersey*).—You seem to have misread my replies most thoroughly; (*a*) I did not say that *I* wished to try experiments, but if *you* wished to do so, I would forward recipes. I certainly have not the time to try them. (*b*) Again, read reply to H. S. B., and you will see I did not say two different kinds of drills are used for glass and china. I know of only one drill (or bit, which you like to call it), and that, as I said in reply, is a diamond chip mounted in tin holder. You do not say what your difficulties are. Finally, although I do not object to writing direct, I prefer answers to appear in "Shop," so that all can share the information.—W. E. D.

Heat for Hatching.—J. W. C. (*Tottenham*).—The temperature ought to be maintained as nearly as possible at 98°. It might, on occasion, rise to 100° without injuring the eggs, but it should never go as high as 104°. These temperatures are on the Fahrenheit scale.—J. L. D.

Varnish and Paints.—TRIO.—In reply to Question A: Oil stain is most suitable for floor margins, etc. You can buy "antique" oak (oil) stain, and this, thinned with turpentine, will make various depths of colour; *burnt Turkey umber* (in oil), used with turps and varnish, also makes a rich and warm stain, but to those readers who want, before all things, simplicity and cheapness, there is nothing better than a small sample tin of Mathieson Bros.' (Ardrossan, N.B.) dark oak "scumbling." This only requires thinning with good linseed oil, or oil and turps mixed, to be ready for use, and will be sent, carriage paid, for 9d. Further particulars in fifth paper of "Graining" series. For finishing the work, two coats of *hard-drying* oak varnish is best and cheapest in the long run. If one coat of varnish only can be given, the stain must be once coated with warm "patent" or glue size. If a *water* stain is used, the work must be twice sized; but when size is used, the varnish does not wear half so well, as it forms a film between stain and varnish, instead of these two becoming one mass—like when painting successive coats of oil paint. A dirty-looking floor will stain *dark* to most advantage. The crevices should be stopped with slips of wood, wedged and glued in, and then chiselled or planed off when set. Query B: The lead work of your stained glass should be rubbed with turps and rag, and cleanly painted once with quick-drying white lead paint; then a bare coat of oil gold size, and gilded with gold leaf (see "Shop," replies on gilding). Finish with a coat of carriage varnish, stained (if "old gold" colour is desired) with a little finest burnt Turkey umber. Question C: The answer in "Shop," No. 59, p. 112, "Imitation Marble," contains all the desired details of painting new wood which you ask for. H. B.'s was a clock case, your article a bookcase; but the nature and treatment are identical, the colour only differing. Your successive coats should be brought on a little darker than the desired finishing enamel colour. Thanks for your tribute to "WORK'S great usefulness"—your "trio" of queries is a very practical demonstration thereof.—F. P.

Electro-Deposition.—W. G. (*No Address*).—You make the very common mistake of confounding the electro-motive force of a battery with its strength. The electro-motive force of a battery is the pressure of the force in its closed circuit, and is nearly analogous to that of a head of water. This E.M.F. is the same in a tiny cell made from a pipe bowl, and one made up in a 10 gallon jar. The strength of a battery current is not only its E.M.F., or difference of potential between its poles, but also its volume of current. It is not only the head, but also the volume impelled by that head. I cannot in this small space answer all your questions relative to the deposition of "gold, silver, copper, iron, nickel, etc." The E.M.F. needed to decompose a solution of any of the metals and deposit the metal in a reguline condition, varies considerably with the composition and tenuity of the solution, and is found by practice. It is usually very low, and rarely exceeds some 3 to 4 volts. The E.M.F. of the current is found by a volt-meter, and the volume by an ammeter. Those instruments will be described in WORK when space can be found for the articles.—G. E. B.

Fixing Pencil Drawings.—NO NAME.—There are several solutions used for this purpose. The following are the best:—(1) Prepare thin water starch the same as the laundress does, of such a strength as to form a jelly when cold. (2) Thin isinglass reduced by water to a size. (3) Rice water. These solutions are all applied in the same manner. If the drawing be small, you can immerse it for a few moments in a bath of any one of these you select; if large, apply with broad camel-hair brush, as in varnishing. There is no satisfactory mode of fixing crayons.—F. B.

Toothed Wheels.—BOWTON LAD.—The question you ask, "How to mark out toothed wheels," is not quite explicit enough, as there are so many different kinds of wheels and teeth, a description of which could not be condensed into the limits of a whole number of WORK, let alone the limited space of "Shop" at disposal. I will explain the method of marking out a simple form of teeth on a spur-wheel, which I hope will be sufficient for your purpose. The term "pitch line or circle" will have to be used somewhat frequently, so I will commence by describing what it is and how it is obtained. Suppose there are two shafts, *a* and *b*, Fig. 1, to be connected, the one to drive the other at the same speed, but in an opposite direction to itself. The simplest way would be, supposing the shafts were near enough, and if friction alone could be relied on, to key discs of the same diameter on the two shafts forming their point of contact in *c*, then the one would turn the other as desired. In practice, however, it is found that friction in such cases is useless. So the easiest method of overcoming the difficulty is to cast the wheels with teeth on. Though the outer ends, or faces, of the teeth of each of the wheels overlap the pitch circle of the other wheel, the diameter is always measured, not over the teeth, but on the pitch circles, which are represented by the two circles, Fig. 1, which, on the teeth of cast-iron wheels, are only imaginary lines, though on the pattern they should be distinct, as most measurements are made either

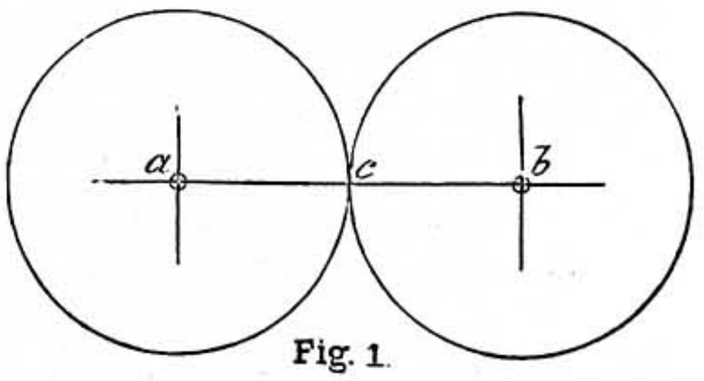
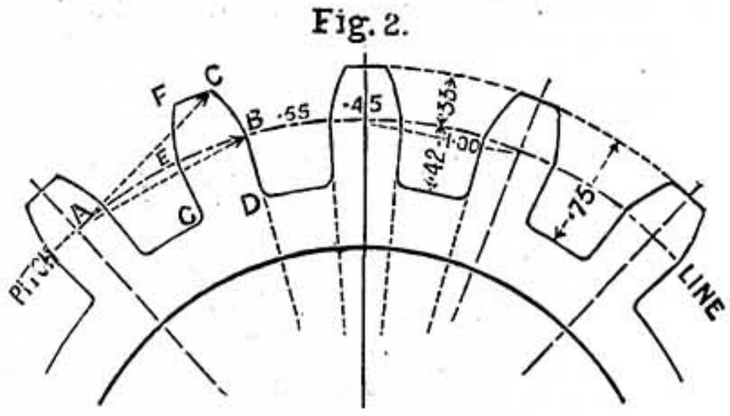


Fig. 1.

Fig. 2.



Toothed Wheels.

on or from them. I have here taken the case of the two shafts going at the same speed; but suppose *a* were to drive *b* at one half its own speed, then the wheel on *b* would have to be double the size of the wheel *a*, measured on the "pitch line"—that is, as if they were two discs just touching. Suppose the big wheel on *b* changed to *a*, and the small wheel on *a* to *b*, then the shaft *b* would run twice as fast as *a*. The greater the pitch of the teeth of a wheel, the more the points overlap the pitch circle of the wheel it gears with. So that it would not do to calculate the diameter on such a shifting quantity as over the ends of the teeth. I have lengthened out these remarks to engraft the fact of what the pitch circle really is, and why the diameters of wheels are measured on them. The "pitch" of the teeth is the distance between the centres of two adjacent teeth or, for facility in measuring in practice, from the edge of one tooth to the corresponding edge of the next *on the pitch line*. Having decided on the diameter of the wheel and the pitch of the teeth, you proceed as follows:—Draw the "pitch circle" (Fig. 2) equal to the diameter of the wheel wanted, and then, with a pair of spring dividers, set off the pitch round the circle, taking care that the compass point in the last division coincides with the point from which you started—that is to say, the divisions must be exact, and a little extra time spent in setting them out will well repay the trouble. Molesworth, in his "Pocket-book of Engineering Formulæ," gives a simple way of obtaining the shape of the teeth, the dimensions of which are as follow:—

From the pitch line to the top of tooth	=	pitch	×	0·33
Total depth of tooth	=	,,	×	0·75
Thickness of tooth on pitch line ...	=	,,	×	0·45
Space between teeth on pitch line	=	,,	×	0·55
Thickness of rim of wheel ...	=	,,	×	0·45

If we now add ·33 of the pitch to the radius of the pitch line, and describe a circle, we shall have a boundary which gives us the limit of the ends of the teeth. Similarly, if we diminish the pitch circle radius by ·42, and describe another circle, we shall obtain the bottom of the tooth. And by again diminishing this last one by ·45, we shall obtain the thickness of the rim. We must now proceed to set off the half of ·45 (the thickness of tooth) on each side of all the pitch divisions and on the pitch circle, when we shall obtain the thickness of all the teeth, as at B E, Fig. 2. I may here remark that the part, B E F C, outside the pitch line is called the face, and B E G D within is the flank. In order to obtain the curve, B C, of the face, we take the centre of the next tooth on the pitch line as centre, and A B as radius, and describe the arc, B C; in a similar manner the face curves of all the other teeth are obtained. The lines, B D and E C, forming the flank, are simply drawn from E and B to the centre of the wheel, and the corners, G and D, rounded off. From these particulars, you should be able to set out teeth of this form, which are called "straight-flanked epicycloidal teeth," and are almost the simplest form of teeth used. I have chosen to illustrate these, as "Shop" space, as before mentioned, is too limited to allow of the somewhat intricate description of some of the more general forms employed. There are also the teeth of bevel and mitre wheels to be described, so I should strongly advise you to obtain a book on the subject, as "Elements of Machine Design," by Unwin, and study the subject thoroughly. "Machinery and Millwork," by Professor Rankine, also goes into the subject at some length.—P. B. H.

Water Motor.—H. V. A. (*Newton Abbot*).—I could not give any guarantee of the efficiency of the motor named. There is, however, no difficulty in getting good water motors. You should write to Messrs. Gwynne & Co., hydraulic engineers, Hammersmith, London, for particulars.—F. C.

Red Stain and Polish.—E. J. A. (*Southampton*).—The red stain as seen on the inside of drawers, bookcases, etc., which does not show the grain of the wood, is usually done by mixing Venetian red with patent or glue size, and applied with a brush. Personally, I prefer to mix with polish or varnish, one part polish to three parts spirits; though I generally save and use for such a purpose any waste stuff, such as may be left from washing out varnish brushes, pots, etc. If it is desired that the grain of the wood should show, this is done by giving one or more coats of polish or varnish, which has been previously stained by adding a few drops of red stain, made by putting twopenny-worth of Bismarck brown in a quarter-pint bottle of methylated spirits. I cannot tell you any particular shop in your neighbourhood where the Bismarck brown may be bought, but it is sold by most oil and colour merchants and druggists that sell shellac and spirits. It will be found a most useful stain if made and used as directed. For particulars of how to polish the outside of your bookcase we must refer you to the series of articles on French polishing, which have appeared in Nos. 105, 108, 115, 119, and 123 of WORK. The latter, which has appeared since your letter was written, treats of one of the final stages—*i.e.*, spiriting off.—LIFEBOAT.

Electric Lights.—SEPTIMUS.—(1) You ask, What candle-power incandescent lamp will light an ordinary room? This depends upon what your idea of an ordinary room may be, and what sort of light you expect. You should give the size of the room, and say how it is lighted. An ordinary room 12 ft. by 12 ft. by 10 ft., will require three lamps of 10 c.-p., or two lamps of 16 c.-p., placed at a height of 7 ft. 6 in. above the floor level. (2) Do you think ten (45 volt, 12 c.-p.) lamps would light, ordinarily, a six-roomed house? Here, again, my reply must be qualified by an explanation of what is meant by a six-roomed house. If the six-roomed house is at all like a large number of eligible jerry-built structures erected in London for the accommodation (?) of workmen, consisting of a front parlour, 8 ft. by 8 ft. by 9 ft.; a back parlour, 6 ft. by 9 ft. by 9 ft.; a back kitchen, 4 ft. by 6 ft. by 7 ft., with bedrooms over to correspond, then we might manage to light up the house with the number of lamps mentioned. But, if the rooms are large, and you wish to have them well lighted, you will want at least three such lamps in each of the principal rooms. (3) If you have a dynamo of 120 c.-p., you should have a ½ horse-power Otto gas engine to drive it, as 120 c.-p. will absorb rather more than ½ horse-power and an Otto will work up to meet the excess. (4) I do not care to recommend a water motor in your case, as you would not get sufficient pressure to work one economically.—G. E. B.

Galvanic Battery.—H. A. O. (*Finsbury Park*).—Although you ask for a galvanic battery, I gather from the other part of your letter that you really want a medical coil. This will be fully described and illustrated in a series of articles on coils, forthcoming when space can be found for them.—G. E. B.

Banjo.—H. H. P. (*Bristol*).—If you put a 16½ in. finger-board to a 12 in. hoop, the strings certainly will wear longer. If you tune your 18 in. by 12 in. and 16½ in. by 12 in. both to concert pitch, you will find, providing you have strung them both with strings of the same gauge, that the 16½ in. one will feel much looser to the touch, and will, in my opinion, be inferior in quality of tone. I should myself string the 16½ in. one with strings a little thicker than those on the 18 in., and thus make up for the difference in the lengths of finger-board. By doing this, the pull would feel about the same as the 18 in. one: the wear of the strings, I should say, would be about the same. Stringing the short banjo with heavier strings would increase the tension of them to get them up to pitch, so in that case there would be really no advantage. Putting on strings of the right thickness has a lot to do with the wear of them. If the strings are too thick they will not stand the increased tension to pull

them up to pitch, and consequently break. Again, the quality of the strings has to be taken into consideration. Some players *will* buy the cheapest strings they can procure; the consequence is, they are continually breaking, and no wonder—how can a string costing 2d. be expected to be as true and wear as well as one costing 4d.? The higher-priced string is really the cheapest in the end, providing the dealer selling them is conscientious, and tests the strings he buys from wholesale houses before offering them for sale to the public. No one would believe, except those who have experienced it, the trouble it is for a maker or dealer to get really good strings for the banjo, and which can be sold at a reasonable price. Strings from a certain maker may be very good, but the next consignment from the same maker may turn out worthless. Then, again, some players' hands perspire very much in warm weather, which means to them an endless breaking of strings; some do not keep their nails short enough, and therefore cut the strings; others do not acquire a proper touch; the nut, tail-piece, or machine-head (if one is used) may have sharp edges and cut them: so you see there are several points to be studied in stringing that much-abused and maligned (but very popular) instrument—the poor old banjo! Wire strings on an ordinary banjo are an abomination, and are not suitable for an instrument without raised frets. There is a string made, or supposed to be made, from Japanese silk, which stands very well, and would be very suitable for players with warm and perspiring hands. The tone is not so good in quality as gut, and when it gets a bit frayed the tone seems to leave it altogether, which are its disadvantages; on the other hand, it stands well. I have also tried a string made from silk exactly similar to "Acribelle" string for the violin, but thinner. The tone of this is also not so good, and pulls much harder than gut, which would prove a great annoyance to a *good* player. On a banjo with a short finger-board the fingering for the high notes would be closer, the frets not being so wide apart as on a long one, which would be considered a disadvantage by some players. I should certainly say the 18 in. by 12 in. "jo" would be the most saleable. At any rate, it is with me.—J. G. W.

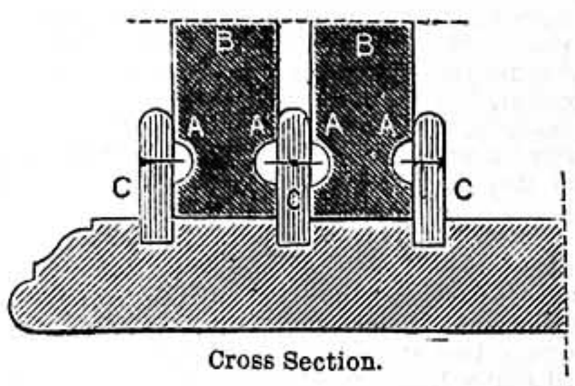
Banjo-Making.—A. E. (*London, N.*).—To answer your query in full would take up too much space here. Refer to back numbers for July 27, 1889, November 3, 1890, Nos. 70, 75, 79, 81, 93, 106, 109, 113, 121, 124. I presume, from your letter, that you are a novice in banjo-making, so should advise you to make an instrument not quite so elaborate as one with an engraved metal finger-board and engraved hoop. You would then be able to see and correct the little faults which would be almost sure to appear in your first attempt, when making your second and more elaborate instrument. I must refer you to the articles that have appeared in WORK for instructions how to engrave your hoop. Metal facings on the handle are generally made of German or nickel silver, and fixed on by drilling a series of holes in the metal, countersinking the holes a little to receive the heads of the screws, then filing down screw-heads level with finger-board. Use screws made of German silver. To engrave and nickel-plate the metal as you propose, you would have to solder pins on the underside of metal to drive in and fix to the handle. You would not be able to fix it from the face side after it was plated. I should advise you to use the German or nickel silver in preference to the last-mentioned; you can true it up and make a good job of it, which is more than you could do with the plated face. If you intend to use gut strings, do not fix a machine to your banjo. They are a nuisance; you will rarely find a player of experience using them. They are all right for show, but you should make appearance a secondary consideration, placing utility and comfort in playing first.—J. G. W.

Iron Feet for Boots.—L. L. (*Nottingham*).—The makers of the iron feet marked $\frac{\text{U. \& Co.}}{\text{L}}$ are Ullathorne & Co., 9, Gate Street, London, W.C., and Albert Street, Birmingham.—W. G.

Instruction in Fretwork.—T. M. (*Birmingham*).—There has not, so far as I am aware, been any article in WORK specially devoted to elementary instruction in fretwork; but from the very first number designs for this art, correspondence regarding it, and useful suggestions for those who follow it, have been of frequent occurrence—so frequent, in fact, that it would be useless for me to attempt any list of them. T. M. would find an advantage in getting a complete set of the back numbers.—M. M.

Picture-Frame Gilding.—G. F. R. (*Redditch*).—On p. 262 (third column) you will find preparations for oil-gilding in their order. First, thin white: then stop up defects in frame; second, clay; and so on. Thick white is only used as a solid foundation for burnishes or flat work, and must not be used on ornamental work, as it would fill up the ornament; also matt and burnish gold-size are only used for burnished parts of frame or flats that fit inside other frames. Clay is procured at the artists' colourman's—Rowney's, for instance—and is ground fine by machinery, known as gilders' clay. Make a weak size (such as described on p. 263) for finish size; and as this is to be put on after gilding, a little colouring matter is mostly used. A few drops of white lacquer and methylated spirits in the finish size will give a white appearance to the gold, or a little saffron will give a yellow tinge, according to taste. Spanish annatto is sometimes used, or other dyes.—H. E. M.

To Guide Sliding Doors of Bookcase.—A READER OF "WORK."—Perhaps you may be acquainted with the ordinary way in which sliding doors of bookcases are made to travel. The sketch is a cross section illustrating the details of the method, with the exception of the pieces A, which I have introduced, and which I will presently explain. Your grievance seems to be centred in the annoyance created by the difficulty of sliding a long, narrow door comfortably and regularly. There is one way by which I think you may effectually overcome the difficulty; and in full justice I must say that my present suggestions result from the simple but excellent device for running drawers truly given by E. W. in No. 121, page 258, Vol. III. B, B, represent the thicknesses of doors; C, C, C, of door runners fixed completely along the front at top and bottom of the top carcase of the bookcase; and A, A, A, A, are the beads screwed along the runners in the positions shown in connection with them. You must groove the top and bottom styles of each door, and place the beads loosely into the grooves, after having taken note of the correct distance each is situated from the outside bottom and top edges of the doors respectively. Then fit the doors within the runners, and screw A, A, A, A, in position, along which will then travel the doors; A, A, A, A, serving as guides to retain them as parallel as possible to the plane of the bookcase. If guides could be fitted to the middle of the doors, so much the better; but with only the amount of opportunity I have at present, I cannot evolve any convenient way. You will find these details rather "ticklish" to fit, but undoubtedly they will tend to prevent the stickiness you righteously complain of.—J. S.

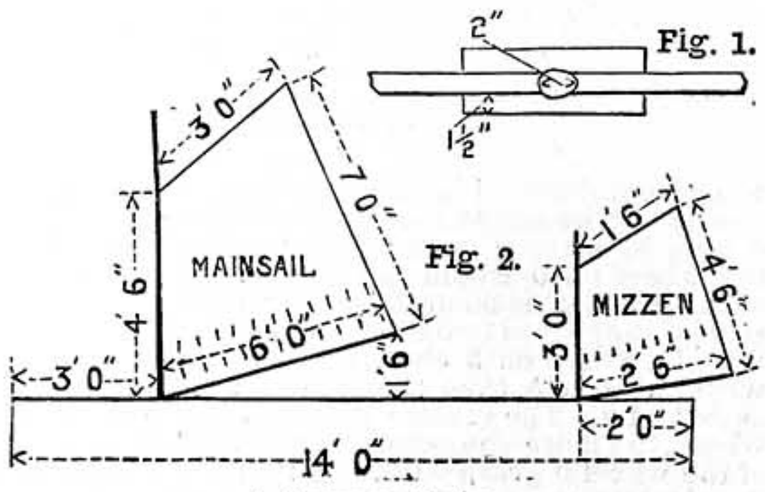


Cross Section.

Sliding Doors of Bookcase—A, A, A, A, Beads, as Guides to be fitted to Top and Bottom Runners respectively; B, B, C, C, C, Door Runners.

Canvas Canoe Sail.—T. R. (*Stoke Newington*).—I do not think it would be safe to use a sail on a canoe as described, for use on the sea; but it might be used with a sail as follows on a river if the captain could swim. If a sailing canoe is desired, I should advise the following alterations to be made: 2 ft. 8 in. wide, with straight stern-post for fixing rudder to; also make provision for fixing two masts, as shown in Fig. 1., and in position shown in Fig. 2. The foot of mast should rest in wood shoe in keel. I think a standing lug-sail would be best, with two reefs in mainsail and one in mizzen. When trying the sail, T. R. could trim the canoe with a few sand-bags as ballast. A canoe like this would easily accommodate two, and would be much safer, the crew acting as shifting ballast.—J. B. F.

Fig. 1.



A Canvas Canoe.

Watch-Case—Engine-Turning or Engraving?—T. H. (*Ballina*).—Which is it that wants doing to your watch-case? If it is engraving, send to Corke Brothers, 29, Northampton Square, Clerkenwell, E.C. If it is engine-turning, then send to J. A. Groom, 8, Sekforde Street, Clerkenwell, E.C. To either you can send the watch-case with perfect confidence, for it will be well and reasonably done. If you particularly desire an estimate, then send a sketch of its size, with full details, and you will doubtless obtain one by return of post. Insufficient details are sent in your letter for forming any idea of cost.—H. S. G.

Improvements on Patents.—IDEAS.—It is quite within the province of any person to make an improvement or improvements on an existing patent or patents, but he will not be allowed to apply it or them to, or use them with, the original patent during the duration of the patentee's exclusive right, except by a licence from the owner of the existing patent. Justice Tindal has said: "When a party has obtained a patent for a new invention made by his own ingenuity, it is not in the power of any other person, simply by varying in form, or in other immaterial circumstances, the nature or subject matter of that invention, to obtain either a patent for it himself or to use it without the leave of the patentee, because that would be, in effect and substance, an evasion of the right." Vice-Chancellor Malins has held that "No doubt a man may make an invention which is partly covered by an existing patent, but he cannot use it without the licence of the patentee. He may wait for the expiration of the patent, and take out one himself, if his invention be novel; and that patent will be valid." Lord Westbury has said: "It is extremely desirable that when a beneficial idea has been started by one man he should have the benefit of his invention, and that it should not be curtailed or destroyed by another man simply improving upon that idea; but if the idea be nothing in the world more than the discovery of a road to attain a particular end, it does not at all interfere with another man discovering another road to attain that end." Lord Chief Justice Hope has said: "A patent cannot be taken out solely for an abstract philosophical principle—for instance, for any law of nature or property of matter apart from any mode of turning it to account in the practical operations of manufacture or the business and arts and utilities of life. The mere discovery of such a principle is not an invention in the patent law sense of the term without the application of the principle to a practical object and end; and without the application of it to human industry or to the purposes of human enjoyment, a person cannot, in the abstract, appropriate a principle to himself." Chief Justice Eyre has said: "Undoubtedly there can be no patent for a mere principle, but for a principle so far embodied and connected with corporeal substances as to be in a condition to act and produce effects in any art, trade, mystery, or manual occupation, I think there may be a patent." Justice Kekewich has held that "A man may invent an idea or a principle—that is to say, a man in his studio may by study, with or without illustrations and experiments, evolve the principle or idea that such a result may be produced by such and such means, and that is, in truth, an invention, supposing it to be new. But that is not an invention according to Patent Law. It is not an invention for which he can receive any protection. In order to bring himself within the law, and reap any advantage from his invention, he must apply it in some concrete form." It should be well understood that a legal patent cannot be obtained for an "idea," which is not by any means an invention or a "property," and can only be made one by giving it a practical form—*i.e.*, by showing the mode in which the "idea" can be made useful, or in other words, by devising a means or mode by which this "idea" may be brought into a practical shape. Unless this is done, the "idea" is useless, of no value to anyone, and must remain so until it receives a practical development. Now, if our correspondent has embodied his "ideas" of improvements in a complete manner, so as to be satisfied of their practicability, and got them into the shape of models or drawings to prove that they are practicable, then he should ascertain that they are novel, and likely to be useful. When, however, he has done this, there still remains the difficulty of having to deal with unprotected inventions, and having to submit them in this state to the inspection and *bona fides* of others whose interests are not those of the inventor. Most persons would say, "Apply for 'provisional protection.'" But then comes the question, is it worth while to do so? seeing what views the law holds on the subject, and the possibility of the existing patentees declining to take them up? Not knowing in what direction our correspondent's improvements lie, we are unable to give him any useful advice, as it might turn out that the patents he alludes to are invalid, in which case the advice would be quite different, cases are so dependent on circumstances. The best thing we can recommend our correspondent to do is to refer to, and read and study, the article relating to patents in WORK, No. 44, Vol. I., p. 694; the reply to R. S. W. (*Leeds*) in No. 109, Vol. III., p. 77; and the reply to F. S. S. (*Leicester*) in No. 118, Vol. III., p. 222. The want of general knowledge of, and a correct understanding of, patent law and its requirements, are great difficulties to inventors, and these are greatly increased by the ignorant, incapable, and presumptuous crudities and lucubrations of amateur dabblers and incapables, who are so fond of parading their ignorant *dicta* as proofs of their erudition and capability, which act prejudicially to the interests of such as are foolish enough to be caught by them.—C. E.

Unworkable Gold.—SILVERSMITH.—The quantity of gold in question being so small, it will be cheapest to sell it to the refiner; but if you have a small melting-pot to hand, and can run it down in a furnace where the fumes can be carried away by the flue, then re-melt it, and when fluid use corrosive sublimate as a flux. Be very careful with this, for it is a deadly poison; and the chemist, before selling it, must be satisfied that it is for a genuine purpose. Have you tried stirring it up, when in a fluid condition, with sal-ammoniac? There is a chance that this might make it workable. Details of the colour and grain of the fracture would have been of assistance, for other causes may be at work than the two I have in my mind in advising the two fluxes above; for example, certain proportions of copper in alloys will very often make gold difficult to use. Your way of making rings from a grain of gold is the same that sailors have when they wish to make a silver coin into a ring—viz., by driving a hole through the centre and then

hammering it into shape on a marlinespike This is too rough a method for anything but fine gold or silver. Why not follow out the method given in two replies to INDEX on p. 357, No. 74, and p. 648, No. 92, of Vol. II. of WORK? In these I warned him, too, of the very fix you are in with your bad gold.—H. S. G.

Waterproof Sole Leather.—A READER.—You ask "the best way for rendering sole leather—that is, hard leather—used in pump work, waterproof." Now, as all boots or shoes, made pumps, are made inside out, and turned to their right side after they are sewn, hard leather is never used. Moreover, pumps are nearly always used for dancing and evening wear, where waterproofing would not be necessary. I hope I may be excused for the above, but I mention it that I in future may answer a question without jumping at a conclusion; for in this case my conclusion is that you want waterproof leather for washers, etc., in suckers of water-pumps (plumbers' work). For this purpose, get a shallow vessel—as a frying-pan—and put some water in it. Put some tallow and neatsfoot oil (equal parts) into a jar, or any stone vessel large enough to receive the pieces of leather; put the leather in the jar with the oil and tallow, and jar into the pan, and put it on a slow fire to simmer (not boil). It is best not to stand the jar on the bottom of the pan, but on a piece of wood ½ in. thick. It will not be necessary to use leather very hard, for, when taken out of the oils and let get cold, it becomes harder than it originally was. The stout but inferior portions are most absorbent, as the fibre is not so dense. It will not want to be left in the oils—only about five minutes—and when taken out it can be thrown into warm water. This will take the surplus grease off the outside, and when the water is cold it can be taken off the top, and put again into the jar, ready to use again.—W. G.

Two-Foot Slide Rule.—L. W. (*Somerset*).—I may say that with this rule there can be a great variety of calculations made upon it. In timber measuring L. W. will be able to measure up boards and planks, round timber and round taper timber, as well as painters' and glaziers' work, tiling and slating, bricklayers' work, mensuration, etc. Also liquid measure and the calculation of the mechanical powers, such as the wedge, levers, wheel and axle, etc. There is no doubt that to have an instrument like the slide rule it may be very handy when one is in a hurry. I may say that I never use one myself; not that they are inaccurate—far from it; if the slide is worked properly, according to Rabone's instructions, everything will be well—but one might make a mistake. I would sooner depend upon calculating; but, of course, that is only my opinion, and everyone has his likes and dislikes on such matters. I cannot give here the tables for calculating by the slide rule, that would be an infringement on Rabone's copyright; but if L. W. would like it, I will send him a book I have on his slide rule, if he will pay the postage.—T. R. B.

Artificial Foot.—DUNDEE.—You cannot do better than write to James Gillingham, surgical mechanician, Chard, Somersetshire, who has made this subject his special study.

Surveying.—KELLY.—A cheap way for you to gain information would be to write to the Civil Service Commissioners, Cannon Row, London, W.; and if, after receiving their answer, you do not think the matter is sufficiently clear, I should advise you to get Cassell's "Guide to Employment in the Civil Service" (3s. 6d.).—E. D.

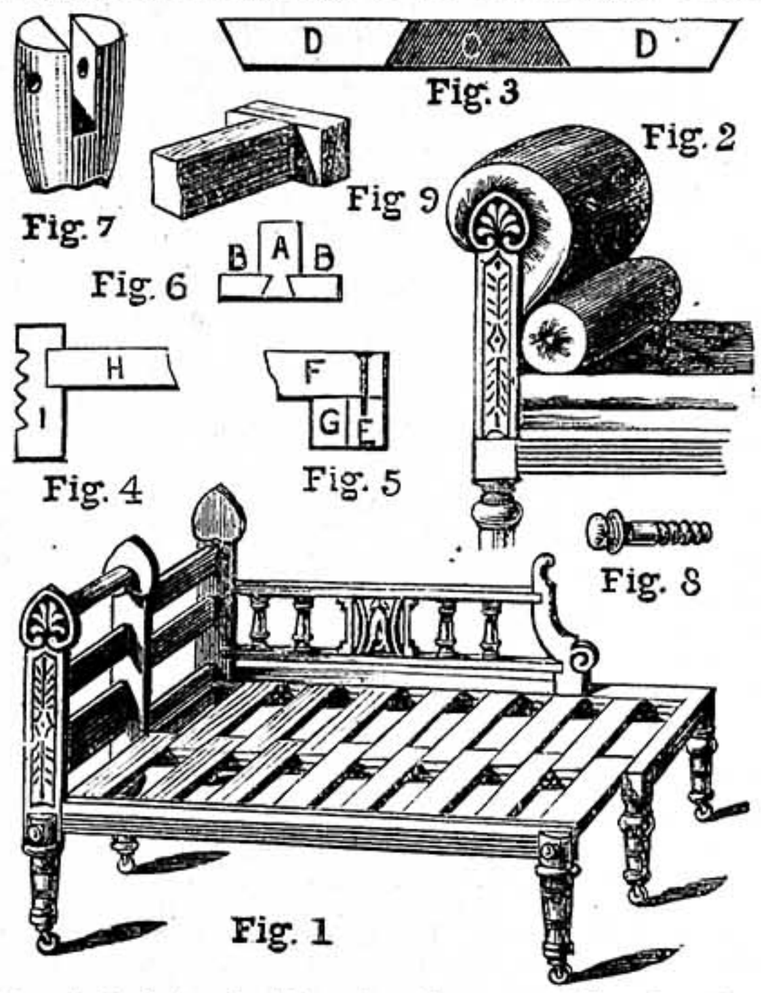
Sundial.—A. R. (*Birmingham*).—You will find the information you want in Vol. II., pp. 18, 104, and 139 (Nos. 54, 59, and 61). The first article treats of horizontal, the other two of vertical, dials. Probably that in No. 54 will serve your turn. When you have read it, you will see whether your gnomon will suit, and why it will or will not. For engraving on your sheet of brass you will need a graver, which you can buy at any tool maker's in your town—say at Townley's in Ball Street.—A. Y.

Angle for Lathe Centres.—INQUIRING SUBSCRIBER.—There is no settled standard for the point of the lathe centres, but there ought to be, as it is impossible to ensure your work running true if transferred to another lathe, which has the centres of a different angle. In America the angle of 60° is almost universal, and all American mandrels, taps, etc., have centres in them of that angle. This angle is thought rather too sharp in England; yet, from the convenience of having a standard, and from the ease with which a gauge for 60° can be made in a bit of sheet metal with a "three-square" file, this angle appears to be gradually becoming the standard in England too.—F. A. M.

Golf Balls.—GOLFER will probably find his difficulty disappear if, instead of softening his gutta-percha by immersing it directly in the water, he softens it in a *water-jacketed* vessel, such as a glue kettle, as the gutta-percha softened by this means will be perfectly dry. In the absence of a glue kettle a double porridge pan would be found to answer equally well; or a tin can of sufficient size, and having a well-fitting lid, might be utilised by placing the gutta-percha therein, and then heating in an ordinary saucepan partly filled with water.—QUI VIVE.

Bending Brass Tube.—MIKADO.—I should like to know what shape you wish to bend the tube—whether into a circle or part of a circle; and if so, what is the size or radius of same? And are you quite certain that it is brass tube, or is it brass-cased, which very many people call brass tube? If you will kindly supply these particulars, I shall, no doubt, be able to help you.—R. A.

Couch Bedstead.—PATTERN MAKER.—I have overhauled your letter and sketch, and have applied the fullest possible care thereto. I have decided that the form of couch I have drawn herewith will be preferable on both the points of strength and facility of action. First, concerning strength. Your sketch shows the front leg blocks of the couch as drawn away from the back parts with the movable framing. This course, if not quite impossible, will prove a source of extreme weakness. All true leg blocks *must* be fixtures to afford accommodation for the framing; otherwise, in the event of the seat-front blocks being drawn forth with the movable slides, no substantial support can possibly be substituted, meanwhile, at the corners where the front rail meets the side rails. The sketch will show you the general construction advisable. Between the blocks of the legs in connection with the couch head-rest should be mortised a stout rail (A, Fig. 6), to which, in turn, will be joined two slips (B, B, Fig. 6). The back ribs will best suit the purpose if dowelled or screwed *above* the back and front rails of the seat proper. Each



Couch Bedstead. Fig. 1.—Frame of Couch: the front portions slide horizontally backwards and forwards upon the back portions. Fig. 2.—Upholstered Scroll and Cushions of Couch. Fig. 3.—Section—C, Front Slide; D, D, Back Fixed Rib. Fig. 4—Section—H, Movable Slide; I, Extreme Front Rail. Fig. 5.—Section—E, Very Long Rail passing the whole of Couch; F, Movable Slide; G, Front Rail of Back Frame (middle in the sketch). Fig. 6.—Section—A and B, B, Rails fixed between Back Couch Heads, above Leg Blocks. Figs. 7 and 8.—Top of Extreme Front Legs and Attaching Screw respectively. Fig. 9.—Back of Couch-Head Slides. (The Front Legs are quite detachable.)

should be in section (as D, D, Fig. 3), as the movable slides will retain their position better, and act more firmly, if they are made in section (as C, Fig. 3). Over the top of the back and end seat rails respectively might be glued narrow strips to form a rebate for the purpose of accommodating the cushions. The front extremity of the end strip ought to be mitred, and project slightly, to meet the end of the movable front (extreme) rail, which should be similarly mitred. Something must be provided to prevent the front slides from coming completely away from the back part of the article; and this is found by screwing a rail (E, Fig. 5) from one end of the couch to the other, and within the framing, underneath, and to the ends of the movable slides. This necessitates having the exposed portions of these rails or slides shorter by the thickness of the back rail of the framing than the fixed or back ribs, as it will be understood that the rail E (Fig. 5) will prevent the movable slides from passing over the back frame rail. The front slides should be mortised into the movable front rail (as H, Fig. 4). This permits the top of the rail I (Fig. 4) to act in correspondence with the strips mentioned previously as forming a rebate for seat-cushion. You will probably understand that the front couch-head slides are mortised to it (the couch head), and travel between the fixed mortise rails between the two back uprights. To each of these slides screw a stop-piece (Fig. 9). The only important point which now remains, and one which I do not think you can possibly improve upon, is the support of the fronts of the slides as a whole. Seeing that the front leg blocks proper cannot be moved, it would be folly, so far as the appearance of the *couch* is concerned, to have, on the movable rail and under the movable couch head respectively, blocks of the same size as the fixed ones, to receive the needful detached legs; therefore I advise you to have thin strong blocks, and legs shaped at top (as in Fig. 7). The top mortise will then fit over the blocks, and if holes are pierced through them and the legs, wooden or metal screws could be used to secure them in position. Used as a bedstead, the appearance of these legs will be of little consequence (I show them different in character for the obvious reason of distinguishing them from the back ones, to avoid misconception as to which are fixtures); but if you consider the holes in the blocks detrimental, you must fill them during the daytime with small patères. The best shape for the stuffing is shown in Fig. 2. It should be so attached that only the thickness of the movable couch head will show when all is closed. A removable bolster used in connection with it will answer well. It seems to me that your sketch represents a band of material round the two long seat cushions to form a hinge. Now, I advise you to dispense with this method, and, instead, completely finish the two separate cushions, and then stitch a piece of material the whole length of the cushions, of a width equal to the two combined, neatly and securely to both edges at one side. They can then be opened, as you desire, to cover the whole bedstead. You must determine the sizes of the couch—perhaps 6 ft. long by 4 ft. 6 in. wide will do. I advise the use of an extra, loose, cushion, of the shape in Fig. 2, hooked over the front couch head at night. See, for constructive details, papers on ottomans, etc., in back numbers.—J. S.

Running Block Tin.—J. McD. (*Glasgow*).—This querist asks how to make block tin run into brass moulds, and how to bring it to a very smooth surface. Well, I can only reply that you must melt the block tin in a ladle with a spout to it, and then pour it into the mould; and as to the smoothness of the surface, if the mould is smooth, the casting will also be smooth, and *vice versâ*. N.B.—In pouring metal into a mould, take care that the mould is free from damp or moisture.—R. A.

Spherical Slide Rest.—X. Y. (*Wandsworth*).—To describe a spherical slide rest fully would occupy three or four articles. I think, therefore, I must refer you to the fifth volume of Holtzapffel & Evans' work on ornamental turning.—J.

Moulding.—H. T. (*West Bromwich*).—The best cheap book is entitled "Practical Iron Founding," price 4s., published by Messrs. Whittaker. A more expensive book is "A Practical Treatise on Casting and Founding," price 18s., published by Spon. Two excellent books are "American Foundry Practice" (West), price 10s. 6d.; and "Moulders' Text-Book," by the same author, price 12s. 6d. They are both published in America by Wiley & Sons, New York, but are obtainable in England of Spon, Strand, E.C., or Trübner, Ludgate Hill, E.C.—J.

Mending Incandescent Electric Lamp.—W. B. (*Manchester*).—If you have some skill in soldering, and can manage a delicate job, the broken platinum wire can be repaired in the following manner: With a fine sharp file clear away a small portion of the glass around the end of the platinum wire, so as to expose about ⅛ in. of the wire. Get a piece of No. 24 copper wire, clean one end, and flatten it out into thin foil. Anneal this on a piece of red-hot iron, clean it with a scrap of fine emery cloth, and tin it as for soldering. This done, carefully trim it with a pair of sharp scissors, and bend it with a pair of small pliers to form a socket fitting the exposed end of the platinum wire. Give this a touch of the soldering flux or fluid, fit on the prepared socket, and solder it on with a small soldering bit, or a carefully directed blowpipe jet. After this is done, the copper wire can be cut off to the required length, and bent to form a loop.—G. E. B.

Broken Mercury Column in Barometer.—R. P. (*Islington, N.*).—The column of mercury in your barometer tube has been broken by a sudden jolting of the instrument when upside down, and thus some air has been shaken into the tube. This must be expelled either by shaking all the mercury into the upper part of the tube, or by heating the tube when upside down, and thus expelling the air from the mercury. Unscrew the clasps which hold the tube, take this out, and hold it upside down, so as to cause the mercury to run into the closed end. Gently tap the tube with the fingers, and thus try to shake the mercury into one unbroken column. If this fails, the tube must be warmed over a spirit lamp carefully, then heated at the closed end and upward, inch by inch, until all the air has been expelled. This done, cork the open end, turn the tube suddenly, withdraw the cork gradually, and thus allow the column to fall into its right position. This done, restore the tube to the frame.—G. E. B.

Electric Belt.—R. D.—Still they come! Inquiries about magnetic belts, galvanic belts, and electric belts, under several different names. Such belts and appliances differ only in name, and my reply concerning one is applicable to them all. If you wish to amuse yourself in making one, follow these instructions. Make a body belt of flannel, or of canvas, or of webbing. Get some pieces of sheet zinc and sheet copper, the size and shape of pennies. In the centre of each fix, by soldering or otherwise, a small brass screw long enough to just pass through the material of the belt and enter a screwed nut on the other side. Fix them in the belt just where you *fancy* they will do you most good. Coat the inside part of the belt with soft wash-leather, and stitch around the discs of copper and of zinc. Get some strips of thin brass, long enough

to connect one stud with another; drill holes in each end to pass over the screwed ends of the studs, and connect the studs as you would a battery—copper to zinc in series throughout the belt. The nuts employed to do this may be rounded at the edges and ornamented, if you like to see them look nice. You will now have a belt equal in value to one costing five guineas at the shops, as its value will depend upon the faith you have in such appliances. See my former replies on similar subjects. —G. E. B.

Electric or Magnetic Appliances?—F. J. S. (*Durham*).—As the magnet adheres to the so-called "Electric Soles" when these are placed in contact with a magnet, you have ample proof that they are made of iron or steel, not of zinc and copper. They may be made of magnetised steel, in which case they are not electric, but magnetic, appliances. Zinc plates will not attract nor be attracted by a magnet, nor can a belt containing zinc plates be magnetised. An electric belt, made up of alternate strips of zinc and copper, will not require being magnetised nor "electrified." It forms in itself an electric apparatus capable of generating a current of electricity when the flannel of the belt is moistened with vinegar or with the saline perspiration from the body of the wearer. The evidence of such a current may be obtained by connecting the two end plates (copper at one end and zinc at the other) with a delicate galvanometer, when the needle of the instrument will be deflected.—G. E. B.

Old Oil Paintings.—A. E. S. (*Wootton Bassett*). —This process requires great care and experience, especially where the picture is obscured by a coat of hard old varnish. This may be removed by spirits of wine and turpentine; but great care must be taken to stop their further action, when the varnish is dissolved, by using water freely, or they will attack the paint as well. Where the picture is merely obscured by dirt, wash with clean soft water, using a soft leather or a sponge. Then dry, or rather polish, with a silk handkerchief. When dry and bright, take a handful of medicated wool, and pour upon it two or three drops at a time of clear nut or linseed oil, rubbing well into the picture—the smallest quantity suffices; then polish dry with a silk handkerchief.—F. B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Microphone.—J. S. (*Enfield*) writes:—"Can anyone inform me where I can obtain a small quantity of the best oven-made coke?"

Oval Bradawl Handles.—C. C. E. (*Lincoln*) writes:—"These are beautifully made in soft wood, such as beech, and I shall be greatly obliged if any reader will tell me how they are turned or fashioned, and where their manufacture can be seen."

Windmill.—YOUNG writes:—"Would any reader kindly inform me, through 'Shop,' how to make a windmill to average about ½ horse-power, its probable cost, etc?"

Inlaying.—J. T. S. (*Sheffield*) writes:—"I am anxious to do some fret inlaying with my machine, but do not quite see my way. I should be glad if any reader would give me the benefit of his experience, and say how the holes, bored to put the saw through, are hidden afterwards? Is the wood cut at an angle to make the top piece fit the lower hole tightly? Any hints, or reference to a source of information, would greatly oblige."

Mining.—PUZZLED writes:—"Could any reader tell me of a good mining school in the Western States, U.S.A.? Any information on the subject would be gladly received."

Varnish.—J. M. P. (*Preston*) writes:—"Will any readers of WORK kindly give me a good receipt for making bookbinder's special varnish?"

Rustic Woodwork.—B. J. B. (*Boddington*) writes:—"Will any reader of WORK kindly give rough sketch of rustic bridge, and rustic arch for each end, with a few hints as to best plan of construction? Also I should be glad of rough plan for a timber storing shed, to be built of timber, and covered with galvanised iron."—[Much on rustic work has already appeared in WORK, Nos. 113, 115, 117, 119, 121, 123.]

Fretwork Picture Frame.—T. W. A. (*Stockton-on-Tees*) writes:—"Will any reader of WORK kindly tell me how to join a fretwork picture frame? It is 20 in. by 24 in. I should have to cut it in two parts. I should also be glad to know of any good book on fretwork."

Mail-Cart Handles.—ADIA writes:—"Can one of your numerous readers tell me where I could get some mail-cart handles, either in Birkenhead, Liverpool, or London? I want those that are bent."

Bath, To Heat.—ROUND O writes:—"Could any of the readers of WORK tell me how best to heat water for a bath having no connection with a boiler or fire, only cold water attached to it?"

Indiarubber Mat.—ROUND O writes:—"Our door-mat, which is of special design, is parting in two in the middle. I shall be glad to know what will repair it, and how it can be done."

Pocket Boiler.—W. M. (*Derby*) writes:—"I should like to know how to make a small pocket tin for boiling water, etc. Lamp—to fit inside when not in use—to burn paraffin or other common oil, and yet not deposit soot. Is this practicable? Would some form of Argand be suitable?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Copper Sheets.—HUMPHREYS & ROSSITER (18, *Arthur Place, Camden Street, Birmingham*) write, in reply to ANXIOUS (see page 267, No. 121) to say that they supply copper sheets ¼ in. by 2 in. by ⅛ in. thick.

Fretwork Thin Lines.—ROUND O writes, in reply to query by PUZZLED (see page 222, No. 118):—"If your wood is not too thick, it could be pierced with a machine needle fixed into a hand vice. You could get a needle as fine as any fret-saw, which would not mar the job. I have seen such lines cut in with a carving tool, which may answer better."

Model Electric Lights.—S. T. (*Horley*) writes, in answer to J. H. (*Wolverhampton*) (see page 254, No. 120):—"You can get carbon plates, dynamos, and electrical apparatus of every description, and cheap, of W. Wells, engineer, Toovies Worth, Crawley, Sussex. Send the size of articles you want, and he will quote the prices for same."

Compound Engine.—H. B. (*Disley*) writes, in reply to PUZZLED (see page 286, No. 122):—"The steam exhausted from the high-pressure cylinder *does* exert a back pressure almost equal to the pressure exerted upon the low-pressure piston. Whatever difference of pressure there is is due to condensation. The back pressure is amply compensated for by the increase of area upon which the steam acts in the L.-P. cylinder. The receiver will be quite large enough in the form of an ordinary cylindrical pipe of an area equal to the steam-ports in the L.-P. cylinder. A good rule is to make the port in the H.-P. cylinder = $\frac{1}{11}$th area of cylinder, and in the L.-P. cylinder $\frac{1}{8}$th area of cylinder. Some of the best makers make the L.-P. cylinder twice the diameter of the H.-P. cylinder—*i.e.*, four times the area."

Chair Seats.—M. (*Bishop Auckland*) writes, in reply to W. J. B. (*Deptford*) (see page 270, No. 121):—"I have found the seats wear very well with fair usage. You can get them in two or more different thicknesses from the ironmongers. If you want to make them in one piece, use birch or beech, but they will cost more."

Portable Furnace.—H. B. S. (*No Address*) writes, in reply to H. B. (*East Hartlepool*) (see page 270, No. 121):—"You wish to have the dimensions, etc., of a portable furnace for melting about 12 lbs. of brass. Look up my answer to G. T. M (Vol. I., page 622). If you had stated in your query whether you wanted a wind furnace or blast furnace, it would have been much easier to answer you. In the reference I have given you above, I described both kinds. The dimensions required are about 2 ft. 6 in. high, 16 in. wide, and 16 in. deep. Perhaps your best plan will be to make it of sheet-iron, bound together by two bands up each side of hoop-iron riveted to the outer case, and to line it inside with fire-clay 1½ in. or 2 in. thick; the chimney may be of sheet-iron stove pipe, about 3 in. diameter, let in at the back. It will rapidly wear out near the furnace, and for about a couple of feet wrought-iron tube would be better, and sheet-iron above that. The top of the furnace may be made of sheet-iron, bent down about 2 in. all round in the form of a box, and filled up with fire-clay. Rivet a handle on to move it by. At the ground level in the front of the furnace cut out a hole, say, 6 in. by 3 in., and 9 in. above that cut another hole, 6 in. by 3 in. At a little below the level of the upper hole and inside rivet two angle irons both at back and front of furnace. These project through the fire-clay and support the fire-grate. The upper hole is for clinkering, and the lower hole for ashes, and to regulate the draught. The holes may be stopped with a brick, or tile, or a door attached to each. The furnace is stoked from the top, and the crucible inserted there also. To prevent the wind cooling down the bottom of the crucible, put a small round tile on the bars to stand the crucible on. During the first heating of the furnace, begin very gently with paper and wood, and allow to cool down, and fill up the cracks with fire-clay; then begin again, but increase the temperature, and fill cracks again. Whenever a crack appears fill it with fire-clay, and allow the furnace to die out of its own accord, so as to cool down slowly. I am afraid the length of pipe required would be very unsightly out of doors, and if you are in a crowded neighbourhood someone will knock it down for you, unless you carry it right up the side of the house as high as the chimney. The best plan would be to carry it into a chimney-stack, and block up the opening to the fire-place, so as to bring the draught right through the furnace."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. P. & Co. (*East Greenwich*); W. B. (*Staffordshire*); J. H. (*Droitwich*); J. E. W. (*Farnworth*); T. F. (*Willington-on-Tyne*); J. W. T. (*Manchester*); J. H. (*Leigh*); J. S. (*Saltley*); A. B. (*Belfast*); A LOVER OF "WORK"; W. R. (*Manchester*); F. S. (*Wyke*); J. J. (*Wigton*); SCOT; D. W. A. (*Fallowfield*); WATCH JOBBER; T. B. (*Rochdale*); F. T. (*Dundee*); B. S. (*Kinsale*); CAMERA; J. H. (*Uxbridge*); G. C. B. (*Echuca, Victoria*); YARMOUTH; E. A. (*Ashford*); VERTICAL; C. McC. (*Bangor*); R. R. (*Dumbarton*); J. W. H. (*Brackley*); P. J. (*Devoran*); G. A. (*Fulham*); T. L. (*Bristol*); INNEK; W. E. M. (*Stawell, Victoria*); VERAX; J. D. (*London*); GREENHOUSE; J. G. (*Liverpool*); T. C. C. S. (*Liverpool*); J. M. P. (*Nottingham*); R. W. D. (*Manchester*); A. E. (*Wandsworth*); S. E. (*Battersea*); J. W. H. (*Nottingham*); PEDAGOGUE; E. H. B. (*Manchester*); A READER OF "WORK"; A NEW SUBSCRIBER; SUBSCRIBER; R. W. J. L. (*Gorler, S. Australia*); J. C. (*Belfast*); H. N. (*Ipswich*); T. S. (*Amsterdam*); A. J. (*Faversham*); A. E. P. (*Hackney*); W. P. W. (*Newport, Mon.*); G. H. (*Shaftesbury*); NORFOLK; H. P. (*Ash-next-Sandwich*); E. F. B. (*Liverpool*); H. H. C. (*Yeovil*); APPRENTICE; H. A. H. (*Chatham*); W. G. (*Bradford*); P. W. (*Devonport*); S. R. W. (*Saltburn-by-the-Sea*); ELECTRO-MAGNET; J. H. (*West Bromwich*); C. W. N. (*Aldershot*); STUDENT; DRAKE; H. McM. (*Bootle*); ANGLO-CYMRO; THE VICTOR CYCLE CO.; A. B. (*Liverpool*); S. A. D. (*Lewisham*); A CONSTANT READER; T. C. W. (*Hull*); SNOB; H. B. (*Hulme*); J. F. (*Tipton*); BANJOIST; J. S. (*Beith*).

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